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Electricity in Catering

IN the vast uncultivated field which remains for electricity to develop one section which holds tremendous potentialities is large-scale cooking. In this issue we draw particular attention to certain aspects of this subject, in the hope that electricity supply authorities and manufacturers of equipment will be encouraged to redouble their exertions to secure this immense market.

The comparative rarity of large electric cooking installations may suggest to those unaware of the history of the subject that the business is practically a recent development. This is not true, for a great deal of useful spadework was done in pre-war days—in fact, we may say pre-Boer War days, for in 1894 an I.E.E. banquet was electrically cooked and in the same year the Lord Mayor and Sheriffs of London were guests at an electrically prepared dinner.

Just before the great War several installations of considerable size were in regular operation, and in an I.E.E. paper read in 1917 the connected load of large-scale cooking installations was estimated by Mr. W. A. Gillott to be 22,000 kW. Less than twenty years after (in their classic paper at last year's I.M.E.A. Convention) Messrs. S. C. Hurry and W. E. Swale made a rough estimate of the load in 1935 and put it at 75,000 kW.

That figure indicated a very substantial post-war advance, but according to Messrs. Hurry and Swale the consumption for large-scale cooking represented probably less than 1 per cent. of the energy sold for all purposes in 1935. The insignificance of this figure is seen when it is placed against the potential business available in this country, which the same authors put at 1,000,000 kW, representing an annual consumption of 900 million kWh.

There has, however, undoubtedly been a speeding-up in recent years. Cases are nowadays constantly coming under our notice of new or converted installations of substantial proportions in hospitals, clubs, hotels, works canteens and other places where the speedy and efficient feeding of large numbers of people is involved.

Mr. F. H. H. Bellamy, in an article in this issue, says that about 700 installations of over 15 kW have been put in during the last twelve months, and he suggests an average figure of 50 kW, which gives an accession of 35,000 kW to the supply authorities, equivalent to a yearly output of 28 million kWh on a basis somewhat lower than the 900 kWh per kW installed put forward by Messrs. Hurry and Swale.

Proceeding at this rate it would, however, take too many years to reach the 1,000,000 kW mark suggested as the limit, but, of course, in such matters there is a "snowball" effect.

Nevertheless, there is room for greater effort upon the part of supply authorities. Their difficulty in the past has been a lack of positive information on the subject, but now a mass of data is accumulating rapidly, and parallels can be found for almost any installation which is contemplated.

The cost of equipment is admittedly a difficulty and suggests that only by some form of hire-purchase will many caterers be attracted to the mains. Such schemes are already in successful operation and should be looked into by other authorities. Maintenance costs can be shown to be almost negligible.

The cost of energy is a simpler matter. All progressive supply authorities should now be able to quote a competitive figure. It seems to be agreed that ½d. per kWh is satisfactory, and even higher rates may be appropriate in given cases.

For the rest, it becomes a matter of salesmanship—salesmanship, however, of a specialist nature, requiring a thorough knowledge of cooking technique and of its equipment.

We repeat that the scope is immense, and hope that the articles in this issue will stimulate thought and lead those supply authorities who have not seriously tackled the problem to look into the matter.

Non-statutory Undertakings

BECAUSE, unlike authorised electricity undertakings, "non-statutory" suppliers of electricity do not have to render returns to the Electricity Commissioners, their number and magnitude are unknown quantities. There are indications, however, that they are a by no means inconsiderable factor in electricity supply. The Commissioners' latest report (p. 10) mentions "Certain non-statutory undertakings (ten stations)" with an output of about 115 million kWh in 1936. In the McGowan Report reference was made to the fact that in the area of one large authorised undertaking thirty-two non-statutory systems were supplying 29,000 consumers and 5,000 public lamps. The McGowan Committee made recommendations regarding the future of such undertakings. These and a number of other matters are dealt with in an article by Mr. G. V. Harrap in this issue which throws some light on a rather obscure subject.

A Costly Lesson

IN consequence of a recent explosion at a local school the Bolton Educational Committee is taking steps to discontinue the use of the gas-heating plant there. The explosion injured one girl and two others suffered shock, and the chairman of the Committee declared, according to the *Manchester Guardian*, that he was not prepared to take the responsibility of continuing to heat the school by gas. We hope that the Electricity Department will take immediate steps to relieve the chairman of this responsibility.

Timekeeping in London

WITHOUT travelling as fast as light it is possible to take a bus at a given point in London and arrive at a place half a mile distant at the starting time. This space-time phenomenon is due to the disparity between London's public clocks, which can occasionally be very annoying. According to an evening paper the London County Council is seeking to remedy this. The Town Planning and Buildings Committee is discussing the possibility of including a clause in the next L.C.C. General Powers Bill to bring about a compulsory synchronising of all public clocks in London. This would appear to involve the conversion of these clocks to electrical operation, which would not be a bad thing for electrical clockmakers. It is reported that a similar step is being taken by the Guildford Corporation, but the chance of such a clause getting through Parliament does not seen to be particularly rosy.

Crompton Parkinson

THE operations of Crompton Parkinson, Ltd., for the year ended at September last are reviewed in the detailed statement by Mr. Frank Parkinson, the chairman, which, as usual, accompanies the directors' report and is abstracted in our financial pages to-day. It will be seen that not only has the net profit on trading and on investments in the various subsidiaries again been substantially increased, but large provisions have been made for taxation charges before the net profit is arrived at. The rates of profit to turnover has been maintained more through improved manufacturing technique than through selling price adjustments, although increased costs have rendered higher selling prices of some products necessary. Progress in electrical plant (new types of special design); in adding to the equipment of the switchgear testing station; in transformer output; in electric lamp ranges and productive capacity; in important electric traction orders; in fire protection apparatus at home and abroad; and in extending facilities for cable production have all been features of a very satisfactory year. What of the outlook? The new financial year has started with a well-filled order book—appreciably better than that of a year ago—and a prospect of continued demand for new equipment for many years to come is confidently seen by Mr. Parkinson. Not only is this justified by the fact that 40 per cent. of the premises in electricity supply areas are still unconnected to supply systems, but it is also fairly based upon expectations of growth in export trade from year to year consequent upon closer co-operation between the principal British manufacturers to obtain "a greater proportion of the available overseas business and on more satisfactory terms."

Manchester Contractors

THERE were some interesting speeches delivered at the annual dinner of the Manchester Area branch of the Electrical Contractors' Association last week. They are reported on a later page. Mr. J. S. Peck referred to the harmful effect of the cut-price competition to which the contracting section of the industry was subjected by outsiders who came in because things were prosperous. He ventured the opinion that there must come a time when destructive competition would be brought under control. The undercutting tendency in the contracting business has been with us so many years that we are still left wondering *when* such a time must come. It might have been imagined that the more prosperous the state of the industry, the less need there would be for the newcomer to undercut, but reports from other districts besides Manchester afford indications which do not point that way. It is a thousand pities that when there is plenty of work to be done it should be done by anybody without a living profit. Mr. Peck alluded to difficulties, which he was not able to discuss, that had arisen between contractors, some electricity authorities and manufacturers, and he urged, as so many have done before him, that the three interests should work in harmony. He advised contractors to put their house in order to make their organisation strong.

Parsons

PARSONS approached more nearly to the popular idea of a man of genius than have most men deserving that title. Probably to most of his audience the most fascinating part of Dr. Gerald Stoney's lecture at the I.E.E. was the glimpse it gave into a mind the workings of which were very often a complete mystery even to the most brilliant and sympathetic of his colleagues. An infinite capacity for taking pains was coupled with apparently sudden intuitions, which gave him a complete knowledge of principles and their applications in a way that he was unable to explain. In many cases these accurately forestalled by many years the working out of the theories by others. The mind of Parsons, however, had in addition an intensely practical bent; to use Dr. Stoney's words, he realised most thoroughly that the first essential in a machine is that it shall run properly and be reliable.

Another Lighting Advance

WHILE the efficiency of the mercury discharge lamp is unquestionably far in advance of previous illumination media, its lack of red rays has been a handicap to its more rapid adoption for certain applications. The principal lamp makers have realised this from the beginning and have been at work to devise means of improving the colour. The agents employed are powders which possess the property of glowing when excited by ultra-violet rays, or "fluorescing." Such powders have already been used in other ways—in the cathode-ray tube, for instance—and now a combination has been found which raises the red emission from mercury-vapour discharge lamps from about 1 to 5 or 6 per cent., which is sufficient to do away with most of the ghost-like appearance which the uncorrected lamp imparts to certain types of object. Although this is only accomplished at the price of some loss of efficiency, the treated lamps which are now on the market will still be well ahead of the tungsten filament lamp and will replace it in many industrial establishments for which the new lamps are primarily intended.

ELECTRICAL CATERING

Palm Court Restaurant, Selfridges [*Elec. Rev. photo.*

Achievements and opportunities

The rapid progress which has been made in electric hotel and catering equipment is evidenced by the fact that one old-established manufacturer has this year almost doubled last year's output of heavy-duty cooking equipment. Low tariffs and a general improvement in the design and efficiency have led to greatly increased use of electrical equipment for catering.

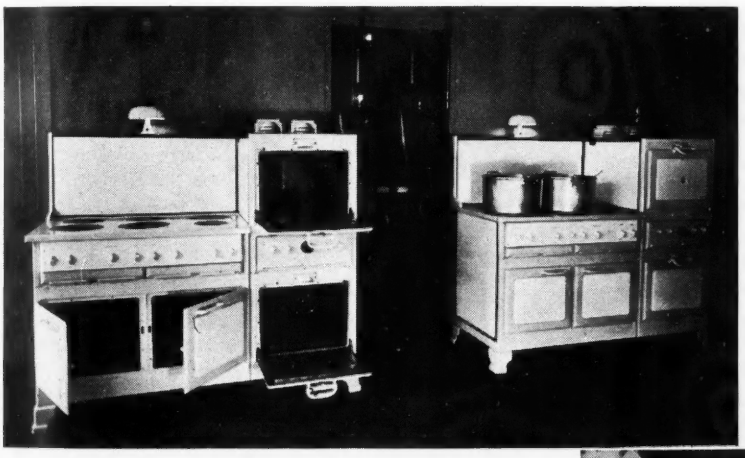
WITH a supply at ½d. per kWh, electricity can work out cheaper than either gas or steam. We have before us two concrete examples of this. A large London hotel used to spend about £30 a month on gas and coal, the latter being used only for the big central range. The entire kitchen is now electrically operated and has resulted in a saving of over £5 per month. A large ophthalmic hospital has added to its electrical equipment. For the second quarter of 1935 it spent £82 on gas and £67 on electricity (£149); for the same period of 1936, with the addition of more ovens and appliances, the amount spent was £38 and £99 respectively, making a total of £137, a reduction of £12 on the quarter despite the extra equipment. The cost of gas in these two cases was 7.3d. per therm and 8.6d. per therm respectively.

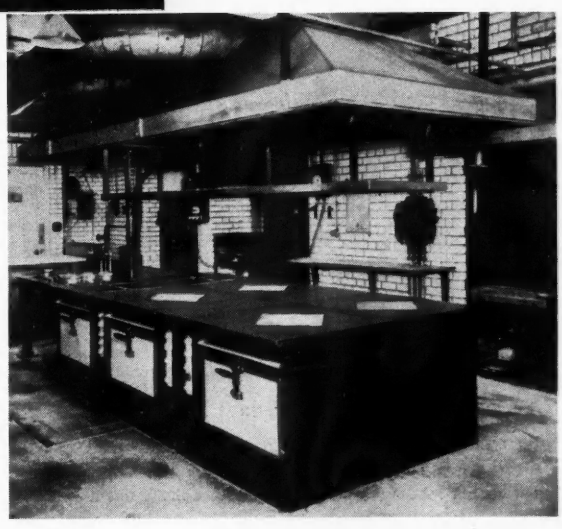
Generally speaking the main opposition comes from the chef, rather than from the management. One of the most successful methods of countering this is to obtain his criticism of the equipment. This arouses his interest sufficiently to get him to examine the equipment in a more unbiased manner. Following this it is frequently possible to persuade him to look over an existing electrical installation, and finally he may be tempted to agree to try some piece of equipment, such as a griller or roasting oven.

We know of a case where one chef said the grills were good and the roasting ovens no use, while another vowed that the opposite was the case. It was to meet a demand of this type that the G.E.C. introduced its solid griller which comprises a table with from one to four plates each measuring approximately 30 in. by 8 in. with a loading of 2.5 kW. The food is placed directly on to heated plates which do not attain red heat but are sufficiently hot to seal the meat and retain the juices.

In some cases satisfied chefs have recommended electric cooking to their friends so that the manufacturers have met with demands usually for identical equipment. But there is no doubt at all that women, appreciating the cleanliness of electrical cooking, take to it almost at once. Manufacturers endeavour, as far as possible, to meet each individual chef's demands, both as regards layout of the kitchen and equipment provided, but the Jackson Electric Stove Co., Ltd., has gone one step further in introducing a special range, actually designed by a chef.

This range can be supplied as a single unit or a number of units fitted together to form an island range. The top flanges are so designed that another oven can be added and fitted flush at any time. The outstanding features of this range are the height, only 2 ft. 9 in., and unusual high loading for the boiling plate. This plate is 15 in. square and has a total loading of 9½ kW; in the centre is a 6.8-kW element, with simmering elements under each corner. With such a high loading it is not practicable to employ embedded construction, and so a special alloy protecting cover is fitted. Control is by two three-heat switches for the centre and one three-heat switch for the simmering parts. As an alternative three 2½-kW and one 5-kW plates can be fitted. So far as the oven is concerned the shallow type with a drop-down door is generally favoured, but side opening doors are available. The loading

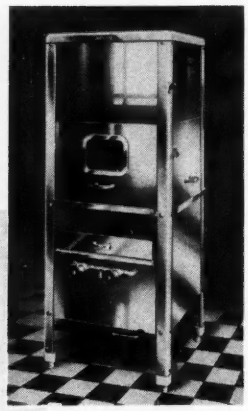


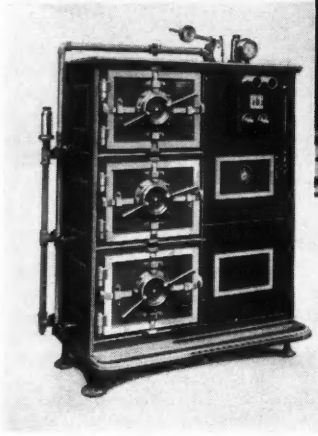


Left: A Moffat No. 296 cooker installed at the Scout Dyke Camp by the Barnsley Education Committee, and (below) a Jackson chef's island range at the R.A.F. Club, London

is just under 5 kW. Side heating elements are generally preferred for "industrial" cooking as with top and bottom heating each dish acts as a heat baffle.

It is usual to-day to find the switching equipment integral with the oven; but it is heat insulated and situated in a special compartment. For wet apparatus, however, wall mounting is to be recommended. The G.E.C. makes a special feature of its oven elements, which, it is stated, being keyed, are sufficiently robust and flexible to withstand gun recoil on battleships.



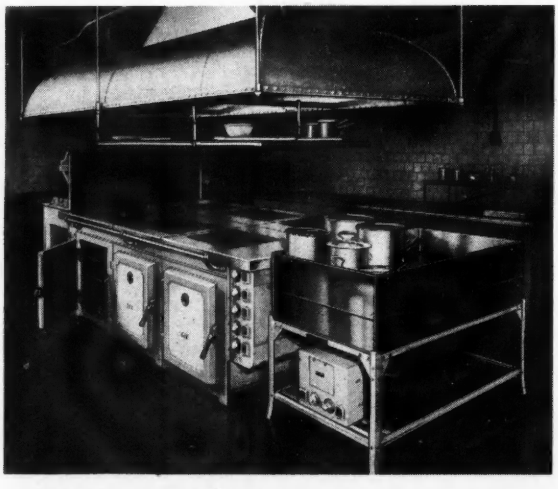


Below: Carron roasting ovens, and (right) the Hotpoint dish-washer

There is also available a wide range of Jackson heavy-duty cookers of normal height (about 3 ft. 6 in.) with the hob mounted above the ovens, similar designs being made by the G.E.C., Archibald Low Electrics, Ltd. ("Highlow"), Carron Company, Tricity Cookers, Ltd., and Moffats, Ltd.

Thermostatic control is advocated by Moffats and Jacksons, especially where cooking operations are carried out on a large scale over comparatively long periods as it simplifies operation and requires the minimum of attention. It is particularly successful applied to large roasting and baking ovens and pastry ovens, and the small extra cost involved has been justified on the score of economy of consumption and the repetition of operations. On the other hand the G.E.C. finds that many prefer three-heat control or wish to avoid complications. For warming cupboards there are again two schools of thought—a small loading on continuously or a higher loading with thermostatic control.

Characteristics of Carron Company's ovens, both heavy duty with swing doors and the galley range, are the mounting of the switches separately and the top and bottom elements. A maximum load of 3½ kW is employed for the boiling plates, which in many cases form whole sections of the cooker or table top instead of just a small boiling plate. The Moffat has the cooking top illuminated and fitted with boiling plates with a maximum rating of 1,800 W for smaller hotels and institutions.



A G.E.C. installation at the St. Berner's Hotel, London

For heavy-duty cooking embedded type boiling plates have proved the most reliable as they are not subject to buckling with the high loadings used to-day. The G.E.C. has a special drench-proof hob and casing and an easily removable plate for cleaning. Separate boiling tables are advisable where there is space, although architects generally cut kitchen space down to the minimum even in modern buildings. The ideal is about 25 per cent. of the space of the restaurant. Such tables as these are made by the cooker manufacturers. The G.E.C. has available a 10-kW boiling plate for its table; the "Highlow" tables are made both with integral switches or with a separate switchboard. Low-loaded plates of from 1½ to 3 kW shrouded against drip, seem to be preferred.

Another "Highlow" table combines a *bain marie* with a 4-kW element. The *bain marie* is what may be termed a wet hot-cupboard. The Carron Company makes a combined cast iron hot-closet (5 kW) with sliding doors and *bain marie* (3 kW) with three 500-W carving recesses. Similar equipment is made by Archibald Low Electrics, Jacksons, Benhams and the G.E.C., who also produce separate grillers of the ortho-fox type with radiant type elements, and electric steaming ovens, which are especially useful for steaming vegetables, fish, puddings, hams, etc., while as the casing is heat insulated and the doors steam-tight the efficiency is high. Immersion heaters loaded at 4 kW are used for the "Highlow," and 5- or 12-kW and 6- or 9-kW immersion heaters, according to the size of the oven, by the G.E.C. and Carron Company. Immersion heaters (6 to 10 kW) are also used by Benhams. External mounting on the underside of the sump is preferred by Jacksons for the 5.1-kW element, so as to leave a clear interior. In each case ball valve automatic water feed is incorporated.

For roasting electric heating undoubtedly holds its own, not having any air draught and retaining the juices of the meat. The G.E.C. models, available in two sizes loaded at 3.6 and 4.8 kW, and the Tricity, 5 kW, have ovens only 2 ft. high which can be mounted side by side to form multiple units, while the "Highlow" units can be mounted one above the other. Cabinet models 3 ft. 6 in. and 4 ft. 4 in. high with 12- and 15-kW side heating elements are made by Carron Company, this type also being favoured by Benhams and Jacksons, whose interesting and unusual design permits the insertion of a lagged shelf, giving two smaller independently heated ovens so that one can be used for baking while the other is in use for roasting. Both the Carron and "Highlow" have two swing doors with centre opening.

The Magrini "Master Server"—a multi-purpose equipment

A short step from the roasting oven is the pastry oven, to which is closely allied the baking oven; in some cases ("Highlow") one oven serves both purposes. Top and bottom elements are generally employed with a loading of anything from 3 to 18 kW per deck, the ovens being fitted one above the other. Drop-down doors and thermometers (Jackson, Benham and G.E.C.) are standard equipment, although the largest Benham oven (11 kW per deck) is made with folding doors. Another specialist in this equipment is the Arora Co. Tricity Cookers have, in addition to a 9.6 kW baking oven, a small two-compartment pastry oven with a total loading of 4.8 kW.

Before leaving the dry cooking equipment mention should be made of the heavy duty toasters which are available. The types made by the Arora Co., Archibald Low Electrics, Carron Company, the G.E.C. and Benhams, take the form of a modified griller. The "Toastmaster" (F. V. Magrini, Ltd.), is constructed on the lines of a large size and more robust domestic toaster; it will toast 300 slices an hour, two or four at a time, and is loaded at 3½ kW. Operation is automatic and can be set for light or dark toasting. The "Euk" 3-kW toaster will toast 200 slices an hour, both sides at once, and when done switches off, rings a bell and shows a red light. The Hawkins toaster will do four slices at a time.

Among the smaller special appliances are a Carron electric

bread prover (2 kW) with a steam spray in the bottom, electric egg boilers rated at from 1 to 4 kW and taking from 6 to 36 eggs at a time, by Archibald Low Electrics, who also supply a water-jacketed 1-kW pie-heater to take 24 pies, and a hot cupboard on wheels, as well as heated food trolleys. The latter are also made by the G.E.C., Jacksons and Bertram Thomas. An interesting speciality by the G.E.C. is a doughnut cooker. A removable welded steel pan houses a basket with a hinged wire mesh lid half-way down; a special raising and lowering attachment is provided which automatically locks when the basket is raised, thus suspending the doughnuts above the fat when draining. The 3- or 5-kW heating elements are of the open coil type. Other G.E.C. specialities are electric scone-baking plates with totally enclosed elements from 4½ to 12 kW and a pressure griller. This griller should be of considerable use to station buffets and canteens as the two 1½-kW totally-enclosed heating plates supply heat to both sides of the meat at the same time, producing grills within 2½ minutes. The Magrini "Jiffy" griller serves a similar purpose, but instead of being hinged the upper half is held by a sliding clamp. An electrically heated doughnut cooker is also made by the Euk Mfg. Co., Ltd. A snack bar griller capable of cooking a steak in four minutes has just been introduced by the Hotpoint Electric Appliance Co., Ltd.; two 7.9 kW "Torribar" elements are fitted. A quick griller is also sold by L. G. Hawkins & Co.

An automatic "Filtomaton" still (Jackson Boilers)

Before passing on to wet cooking mention should be made of waffle bakers. These are supplied by Henley's, L. G. Hawkins, and F. V. Magrini; that of the last-named is thermostatically controlled.

The "Crypto" dough mixer in action

While considerable use is made of ordinary flat-bottomed utensils on special hot plates for heating stock (G.E.C.), there is a "Highlow" soup boiler with integral element and heavily lagged container, specially designed for economical operation. Another model of the same name has a special white enamelled body. When a conversion scheme is put in hand, the chef naturally wishes to carry on with the introduction of separate elec- economy should be discouraged by tice which on the grounds of out on the boiling table, a prac- ing and fish frying to be carried is a tendency for vegetable boil- the old utensils, and there trically heated vegetable boilers and fish fryers.

A vegetable boiler of this type is made by Jacksons. It incorporates an element fixed to the underside of the pan, lift-out copper steamers and fine wire mesh baskets for holding the vegetables, in capacities of from 4 to 30 gal. with loadings of from 2½ to 9 kW. Archibald Low have two two-tier models rated at 15 and 20 gal (4 and 5 kW).

Where the demand for hot drinks is mainly of a periodic nature, as in canteens and the larger hotels, hot water, milk and coffee urns are satisfactory. The Jackson coffee and milk urn has the element clamped to the under-side of the pan and the milk container is surrounded by a water jacket with gauge glass, taps being fitted for running off both liquids. There is also an urn for water only. The corresponding urns of the G.E.C. are also fitted with clamped-on elements (of the strip type) but in this case the switches are integral with the appliances; Carron Company also makes urns of this type, while Hawkins have a 1-gal. coffee urn.

For buffets, etc., where the demand for a hot drink must be met immediately at any time of the day a still-room set is essential. A typical example of this type of apparatus is the set made by Jackson Boilers, Ltd., incorporating a fully automatic self-feeding water boiler, which delivers boiling water within a few minutes of switching on, and a milk and coffee urn on either side on the "Filtomaton" system. Loadings are from 3½ to 7¾ kW with "Chromalox" elements with removable flanged blades; the café fountain type, specially constructed for counter use is rated at 15¼ kW. W. M. Still & Sons, Ltd., have an automatic boiling water and coffee-making apparatus which infuses with aerated water passed first through a cooling coil, and stores the coffee in "Pyrex" glass jars maintained at an even temperature. The same company produces counter sets comprising boiler, coffee machine, milk urn and egg steamer.

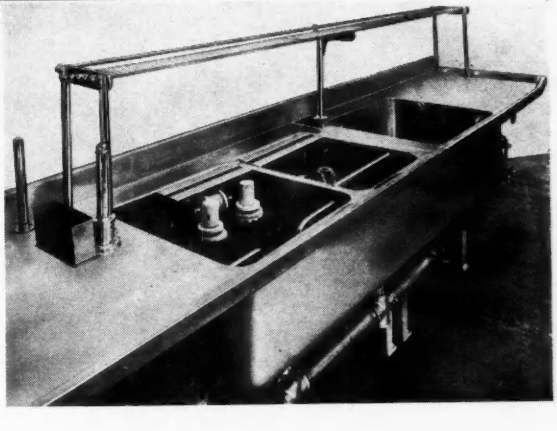
The fish frying business offers an attractive load to the supply undertaking, and the subject is dealt with elsewhere in this issue. There is, however, a demand for the smaller type of fish fryer in hotels and canteens, and this differs considerably from the heavier type designed for continual use in the fish-and-chip shop. For hotel use there is the Arora (4½, 9, 13 and 24 kW), Tricity (25 kW), Jackson, "Highlow" (10, 15 and 20 kW) and Carron (18 kW). For fish-and-chip shops and heavy-duty equipment the Acme Engineering Co. and John Rouse (Oldham), Ltd., are specialists. The latter's 34-kW range is fitted with a special safety switch in the base for isolation, and there is a steam-extraction system.

Before leaving cooking equipment entirely mention should be made of the Magrini "Master Server" which, in a single unit, combines a hot cupboard, carving well, *bain maric*, toaster, rack, bread board and crust bin, "Jiffy" griller and radiant griller with a total loading of nearly 10 kW.

Apart from cooking, electricity in the kitchen can effect a great saving in labour. Chip cutting is one example of this. One of the most interesting chip cutters is the "Crypto" appliance, which eliminates bruising by the avoidance of the use of pressure on the potatoes, an automatic cutting action being employed both for the slicing and the subsequent chipping. Two fittings provide either square or corrugated chips. The "Peerless" machine incorporates a device to ensure that the potatoes are fed in one at a time, a rotary cutting action being employed.

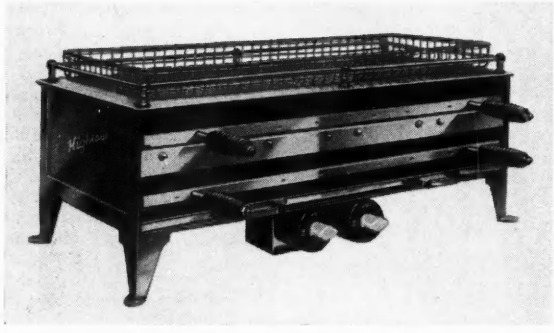
In electric potato peeling two methods of operation are favoured—friction against carborundum linings and knife cutting. The former seems to be the most popular. The "Crypto" peeler, employing special carborundum alloy, is designed to take off only the outer skin, thereby retaining the valuable properties of the potato, and preventing waste. It is claimed that it will

Left: A "Peerless" potato chipping machine. Below: The Staines "Splendid" crockery-washing equipment



provide 100 lb. of peeled potatoes from a total input of 112 lb.

Carborundum linings fused on to cast-iron segments are used in the "Alpha" (J. Phillipson & Co., Ltd.) and Kent Dish Washing Machine Co.'s peelers. In both these cases the motor is situated on top of the peeler, being mounted vertically. The Medcalfe "Audrey" also employs carborundum, but has been largely superseded by the company's "Staybrite" steel model. Bruising is eliminated by the use of a steel lining and



A "Highlow" heavy-duty toaster

a contoured revolving base, both perforated with countersunk holes with razor-sharp edges.

One of the biggest and most unpleasant tasks in hotel kitchen work is washing-up. There is a large number of electrically operated machines available for this purpose. Simplicity is the keynote of the Hotpoint, the lower section of the machine acting as a storage tank for the wash water, which is forced by an electrically driven pump through the reciprocating radial wash arms. A revolving wash arm is also employed by the Hobart Mfg. Co., Ltd. The W.M. Still machine combines both the rack and conveyor type of operation. The "Euk" dishwasher is constructed

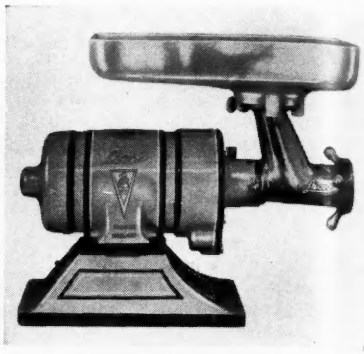
The G.E.C. pressure griller

of cast-iron, the dishes being totally submerged in violently surging water. The "Splendid" crockery washing machine (Staines Kitchen Equipment Co., Ltd.), which has hitherto been made in teak, is now available also in stainless steel. It employs brushes which clean the crockery while submerged in water.

Both rack feed and belt conveyor type "Champion" dishwashers are sold by Medcalfe & Co. Mechanical simplicity is the keynote of these spray type machines.

Since coffee loses a great deal of its value soon after it is ground, the advantage of freshly ground coffee to hotels and restaurants is obvious. The "Crypto" coffee grinder is a good example of this type of equipment; the "Non-Fayl" is made by the Morecambe Electrical Equipment Co., Ltd., another machine being made by the Hobart Mfg. Co. Specialists in coffee roasting and grinding equipment are the Uno Company, whose electrically heated roasters have the element mounted concentrically on a drum, the coffee being subjected to radiant heat. With a supply at ½d. per kWh the cost of roasting is approximately 8d. per cwt. An arrangement of intermeshing tooth knives is employed in the "Uno" mill.

For mincing meat and preparing shredded suet, potted meat, crumbling dried bread, cutting-up apples,

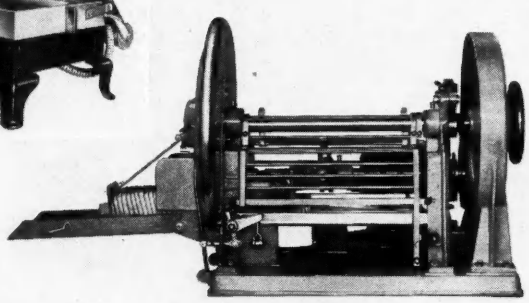


A Herbert meat mincer

stoned dates, figs, etc., meat mincers or food choppers may be used. For "Delicatessen" a combination mincer and bowl cutter is useful: machines of this type are made by Lancashire Dynamo & Crypto, Ltd. The "Atomite" (G. Phillipson & Co., Ltd.) is a suet shredder, provided with an ice-jacket or water cooling, and specially designed to avoid heating and pulping the suet. Another product of the same company is the "Crystal Clarifier," a thermostatically controlled low-temperature apparatus for converting fats and trimmings into dripping and lard.

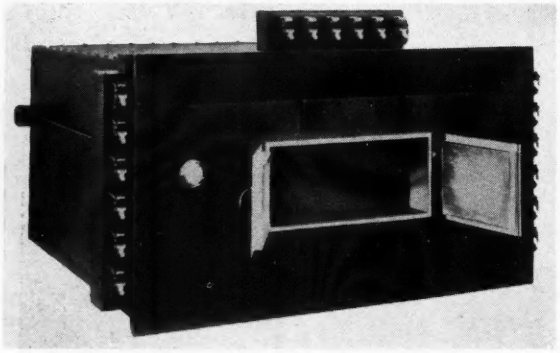
The pastry-cook will appreciate an electrically operated cake mixer. Several small models are to be recommended for hotel use, rather than one large one, to enable several operations to be carried on simultaneously. There are various models of "Crypto" mixer, and the Medcalfe "Audrey" is obtainable with mincing, grating, grinding and soup straining attachments. Drink mixers are a useful accessory; they are sold by the G.E.C., L. G. Hawkins, A. C. Gilbert and Gaskell & Chambers, Ltd.

In order to minimise the tendency to crush the loaf the "Euk" bread cutter is serrated where it enters the loaf, introducing a sawing action. The action is entirely automatic, 180 slices being cut per minute. An electrically driven knife-cleaner, capable of cleaning 500-800 knives per hour, is a useful accessory by G. Kent, Ltd., while both Lancashire Dynamo & Crypto, Ltd., and Bylock, Ltd., make electric hand dryers employing a jet of hot air. These are eminently suitable



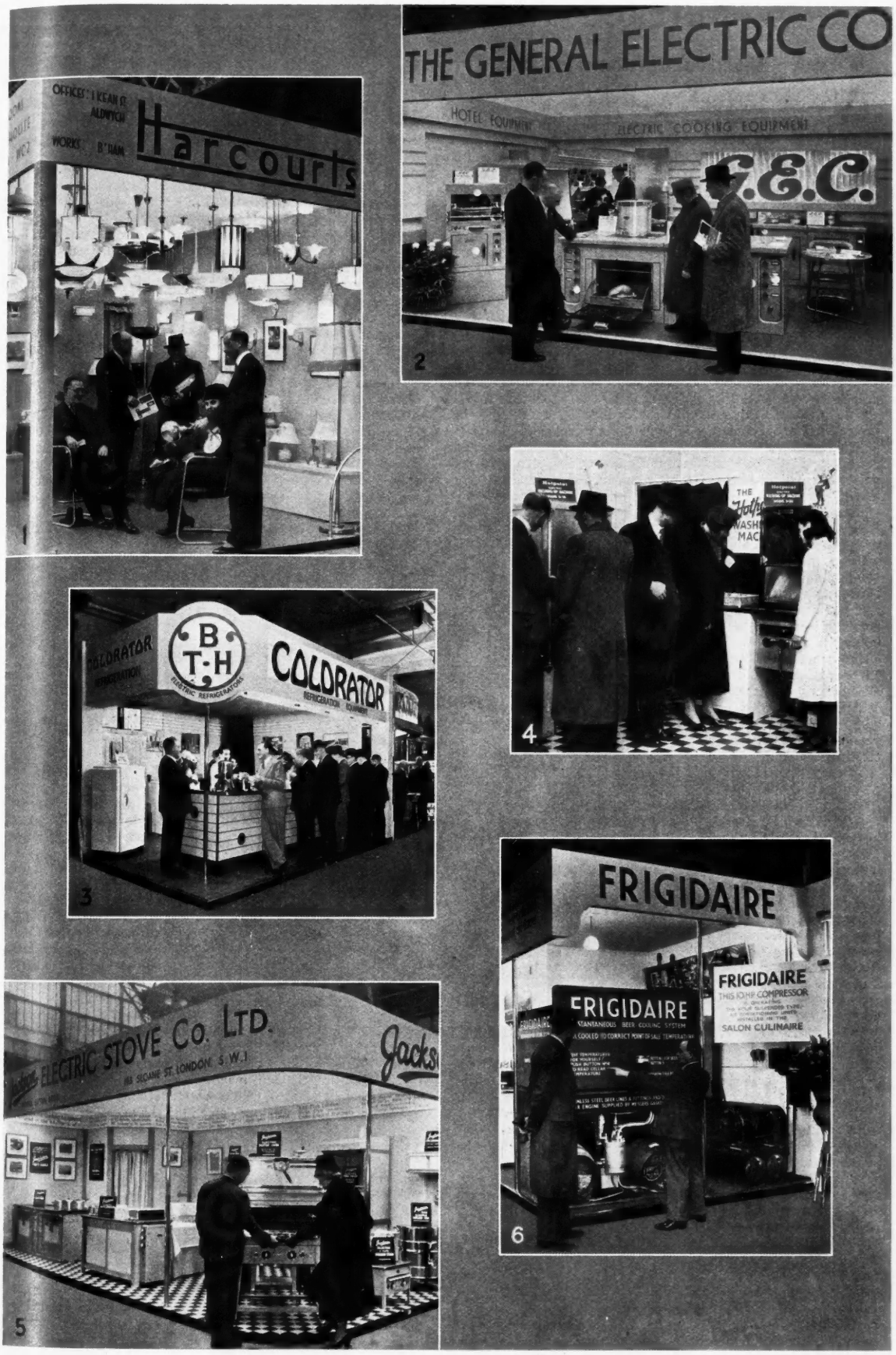
The "Euk" bread slicer

for hotel and canteen use, and can, if necessary, be adapted to work on the penny-in-the-slot principle. This principle is also employed in the construction of special prepayment meter hotel electric fires, as made by British National Electrics, Carron Company, the G.E.C., the Hotpoint Electric Appliance Co., Ltd., and Ferranti, Ltd.



An Arora baking oven

The G.E.C. table type griller with elements clamped to the underside of the plates



[*Elec. Rev. photos.*

Activity at the Hotel and Catering Exhibition (See next page)

1. A hotel proprietor inspects lighting fittings at Harcourt's stand. 2. Business with turkey by the G.E.C. 3. Serving iced drinks at the International Refrigerator Co.'s combined snack and milk bar. 4. A Hotpoint washing-up machine in action. 5. Mr. F. H. H. Bellamy, of Jacksons, demonstrates a pastry oven. 6. The Frigidaire beer-cooling system

A Marked Advance

Apparatus shown at Olympia

A review of the equipment to be seen at the Hotel, Restaurant and Catering Exhibition

AN excellent opportunity to see much of the apparatus described in the preceding article—and a good deal more besides—is provided at present by the Hotel, Restaurant and Catering Exhibition which until next Wednesday is being held at Olympia, London.

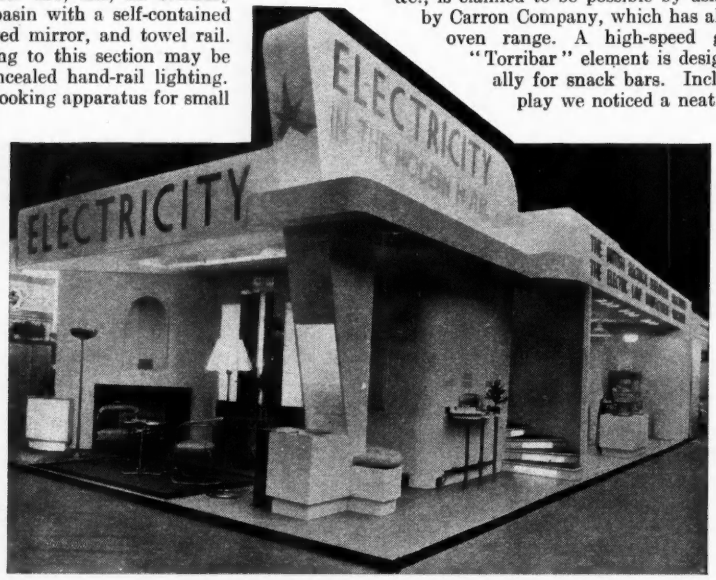
Both in numbers, variety and quality, electrically operated equipment shown easily surpasses that at any similar previous exhibition. Of outstanding interest is the large display which the British Electrical Development Association and the Electric Lamp Manufacturers' Association have arranged jointly. This is intended to demonstrate the indispensability of a complete electrical service, four separate sections showing the particular applications of electricity to the lounge, bedroom, kitchen and laundry.

Advantage is taken in the model lounge to show some of the latest forms of decorative lighting. A combination of frosted glass and mirrors with concealed coloured tubular lamps is very effective, while concealed lamps in recesses over fireplaces and in ceiling coves are shown to provide many opportunities for originality in colour lighting. Examples of typical modern standards include both direct and indirect lighting models. The lounge is also used to demonstrate the various forms of electric heating apparatus available, such as imitation coal fires, convectors, tubular heaters and skirting panels.

Equipment in the bedroom comprises bed-head and bed-side lighting fittings, a meter fire, fan, an ordinary water heater, a wash basin with a self-contained water heater, illuminated mirror, and towel rail. On the staircases leading to this section may be seen stair riser and concealed hand-rail lighting.

A complete range of cooking apparatus for small hotels includes a mixer, potato peeler, dish washer and hot-cupboard, as well as various types of ovens, fish fryers, vegetable boilers, &c. Demonstrations of electric cooking arranged by E.D.A. are given daily in a theatre in the gallery. A typical water heater, wash boiler, washer, drying cabinet and exhaust fan are installed in the laundry section.

Apart from these four special sections, space has also been found to show lighting fittings for different purposes and applications.



The E.D.A.-E.L.M.A. stand at Olympia [*Elec. Rev. photo.*

The G.E.C. is drawing attention to new forms of lighting, in particular the use of four-colour "Osira" fluorescent tubes. The matching of electric lighting fittings to harmonise with the general decorative scheme is a speciality of Harcourts, Ltd., whose "Neutrone" shades are proving popular. In addition to examples of "Harcoray" shop window reflectors and combined heating and lighting units, this company has novelties in the way of its "Tele-flexo" standard and the calendar desk standard.

The public is able to test for itself the effect of fitting to an ordinary lamp the new prismatic ring produced by the Amplilux Lighting & Illumination Co., Ltd. The swing of the foot-candle meter leaves no doubt as to the economies that may be effected by its use. The ring, which can be fitted in a few seconds, is claimed to be unaffected by heat or dust and to last indefinitely.

Several manufacturers are finding a big demand for fires incorporating their own slot-meters and the G.E.C. is showing for the first time an inset or outset model with the meter concealed from sight beneath. A parabolic reflector fire with the meter on top is displayed by Hotpoint, while ordinary inset models are featured by Eastwoods. W. T. Driver now markets a heating attachment for electric fans. Three sizes of electric hot water radiator with loadings of 750, 1,000 and 1,250 W respectively are available from Morris Heating Appliances, Ltd.

Probably in no section of the industry has so much progress been made as in electric cooking. Every effort is being made by manufacturers to render apparatus more and more attractive and the greatest care is being taken even over comparative trifles.

The range which forms Jackson's principal exhibit has been designed in consultation with chefs. This is being actually demonstrated. It is of unit construction and is provided with thermostatic control, a feature which is apparently finding readier adoption than in the domestic field on account of the continuous use of the apparatus over a long period. Improvements have recently been made in the design of this company's steam oven to prevent clogging of the water pipe, the ball valve now being incorporated in the base.

All corners are rounded for easy cleaning on the new "streamlined" G.E.C. apparatus, representative of which are a warming cupboard, *bain maries*, a double oven range, grills and fish fryers, all finished in neutral grey vitreous enamel and chromium. An improved type of roller door has been fitted to the warming cupboards. Any number of the new solid type grill units loaded at 2¼ kW each can be mounted together.

The retention of practically all the natural juices of meat, &c., is claimed to be possible by using the latest grill shown by Carron Company, which has also on its stand a double-oven range. A high-speed griller with a 3,700-W "Torribar" element is designed by Hotpoint especially for snack bars. Included in the Prosper display we noticed a neat range of fish fryers, the "Quickserv" and the "Lunchmaster."

The "Thermotainer" cafeteria service unit is a new idea found among the Magrini exhibits. In the display stand in the front food can be kept hot and in good condition for any length of time, a double glass container preventing drying up.

The kitchen provides numerous other uses for electricity. Peerless and Hobart can meet all requirements in the way of food preparation machinery. A 10-lb. "Alpha" potato peeler is now made by John Phillipson & Co., whose products also include the "Atomite" multi-shredder and the "Crystal" clarifier.

Still greater safety is afforded by improvements to the guards of the Euk bread-slicing machine. A new gravity feed slicer, the "Globe," appears on the Harcourt stand.

Many new dish-washing machines have recently come on to the market. Hotpoint have a complete range, while Medcalfes have added to their eighteen existing "Champion" dish washers a 1,500-piece per hour model with a refrigerator built in beneath. Stainless steel is now used for "Still" models.

A combined milk bar and luncheon bar is a feature of the International Refrigerator Co.'s stand. New Balcombe apparatus is a *de luxe* model bottle cooler, refrigerators and storage cabinets of all sizes, and an ice-cream conservator. A continuous freezer is shown by York Shipley.

Recently it has become a fairly general practice to cool draught beer in the cellars. This has the disadvantage, the Pressed Steel Co. tells us, of putting a stop to the natural conditioning of the beer. Under its new system, the cooling takes place actually under the counter.

For temperatures of not lower than, say, 40 deg. F., Frigidaire are making a 170-cu. ft. cabinet fitted with a ½-h.p. compressor and a blower.

For air conditioning buildings where it is not possible to provide conduits Balcombe are supplying the "Mayflower Comfort Cooler." Ozonair show for the first time a 1,000-cu. ft. per minute ventilating equipment with ozonator.

Large-scale Cooking

By F. H. H. Bellamy

A valuable load

A review of past achievements with some indication of the possibilities in this remunerative field

THE development of the domestic cooking load was made possible by the provision of facilities, cheap tariffs, &c., to enable consumers to enjoy its advantages economically. The value of the load to the undertaking is acknowledged, but a comparison with the large-scale electric cooking load is interesting, and it should be realised how large-scale cooking does provide a considerable extra output.

Actual figures do not exist covering the whole subject under review, but from records available and a close study of the market it may be assumed that for every kW of domestic cooking equipment installed an average of 400 kWh per annum is obtained. Each kW of large electric cooking equipment installed will give from 600-2,000 kWh per annum. The large variation is accounted for by the many types of installations, ranging from the hospital up to the large hotel, restaurant or club, providing elaborate menus both *table d'hôte* and *a la carte*.

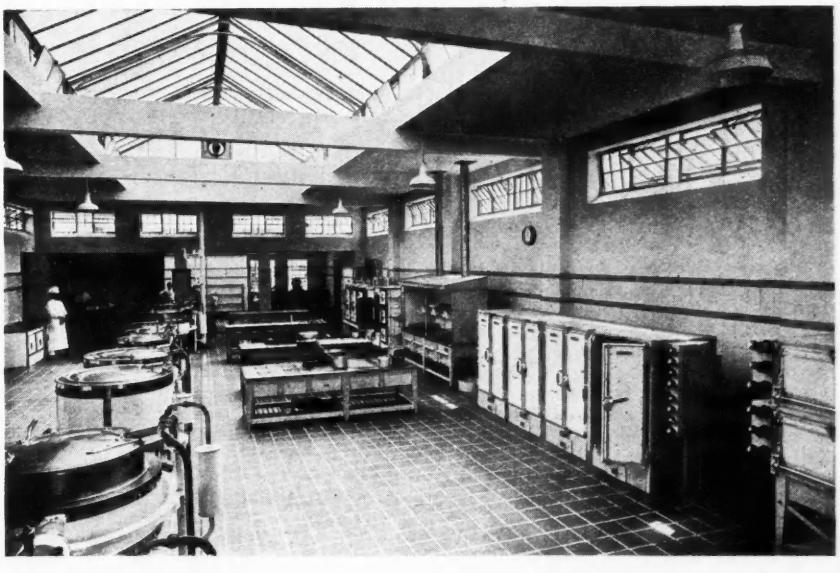
As a further illustration of the value of this large cooking load during the last twelve months approximately 700 cooking installations rated at over 15 kW each were installed in Great Britain; a large number of them ranged from 100 to 200 kW each, including one hospital installation of 800 kW.

Mr. F. H. H. Bellamy is manager of the Large-scale Cooking Department of the Jackson Electric Stove Co., Ltd. [*Elec. Rev. photo.*

This number of installations did not, however, include the many large baking ovens and saloon fish and chip fryers which together must account for some thousands of kW of apparatus installed. If we assume the average of the installed load of the 700 installations to be 50 kW (a conservative estimate) this gives an installed load of 35,000 kW for large cooking equipment for twelve months. On the basis that each kW installed provides an average of 800 kWh (again a low estimate) per annum, a very useful figure of 28 million kWh per annum is arrived at.

An estimate of the consumption of the installations referred to and including the saloon fish and chip fryers and large baking ovens would be in the region of 38 million kWh per annum, thus demonstrating the importance of this load to the electricity supply undertaking.

During the last few years many large installations have been laid down in the kitchens of hotels, restaurants and clubs, practically all of which are operated by chefs. It was not so very long ago that it was considered a very great accomplishment to install electric cooking equipment in a kitchen where chefs were in charge. But the chefs' objections have been largely overcome by cooking equipment specially designed to meet their requirements, and there are many island ranges now in use which embody ovens of the correct design and with boiling hobs conforming to their ideas. These have replaced many coal-fired island ranges and auxiliary gas equipment. It is a fact also that many of these chefs have become an important link in the chain of negotiations for new installations by recommending the equipment to their brother chefs.



The main kitchen of the Runwell Mental Hospital, including large roasting ovens, boiling tables, pastry oven, fish fryer, boilers, &c. [*Elec. Rev. photo.*

It is well known that with good planning in the kitchen electric cooking equipment will provide more cooked food per foot of floor space than any other type of cooking apparatus, and ensure the maximum efficiency with minimum operating costs. When a new building is being equipped it is generally possible to consult the architect to ensure that the size and position of the kitchen in relation to other services is suitable for the demands likely to be made upon it. When, however, it is a question of converting an existing kitchen to electric cooking the manufacturer, by studying the conditions, can provide appropriate equipment. These factors have had their influence on the design of some of the equipment and the lay-out of the kitchen.

Control Equipment

It used to be a common sight to see equipment placed along all the available walls with separate switchboards mounted away from the equipment on the walls with metallic flexible tube or conduit from the switchboards to the apparatus. To-day, however, apparatus has been redesigned with the switchgear suitably mounted as an integral part of each item. The design is such that the lines of the equipment have not been spoiled and the controls are easily visible and accessible to the operator, and their being at hand where cooking is being done reduces the number of paces which previously had to be taken many times during the day to the wall to alter the controls. This raises the efficiency of the staff and incidentally the psychological effect is important.

This arrangement does reduce the consumption of electricity as the staff will more readily use the switches on the equipment in preference to taking the extra paces to the wall switchboard. It will be appreciated that with equipment of this design a much more efficient layout of the kitchen can be obtained by utilising island positions which ensure the steady flow of materials through the kitchen from the raw state to the cooked food ready for use.

This arrangement of equipment with its own switchgear built in applies to most pieces of apparatus but not to "wet" cooking, involving equipment for vegetable boiling, steaming, soups, stocks, &c. These should generally be placed near to the vegetable preparation section and sinks, and due to the nature of the operations are generally supplied with separate switchboards for wall mounting adjacent to the equipment.

In addition to thermostatic control for ovens and hot cupboards, automatic devices are being fitted to vegetable and soup pans, steaming ovens, and water, coffee and milk urns, to prevent damage to the vessel or the elements should they be allowed to boil dry or switched on when empty.

The general practice to-day when dealing with vessels for "stock" is to provide a stockpot stand with a suitable number of heavy-duty boiling plates and separate flat-bottomed non-

electric stockpots. When it is not required for stock the stand can be used as an auxiliary boiling table, and the stockpots may be thoroughly cleaned by complete immersion in boiling water; this is necessary due to the varied nature and corrosive effect of the materials used in the stock.

Many large canteen and hospital kitchens have been equipped during the last twelve months with electric cooking apparatus, and it will be apparent that in these types of installations where the cooking is of a routine nature providing "plain" meals, the number of pieces of equipment will be less than required in the hotel, restaurant or club kitchen where more elaborate meals are served over long periods. It is from such installations that the industry can obtain very valuable information as these provide a most economical case for large electric cooking, consumption figures of from 0.4 to 0.7 of a kWh per person daily being obtained.

Hundreds of Installations

The large electric cooking load is increasing yearly, but it is significant that this growth so far is unfortunately confined to a comparatively few areas where the electricity supply authorities have realised the value of the load and have introduced facilities to make it attractive to the consumer. Many hundreds of installations in the last few years have proved that the design and construction of this large equipment is on sound electrical and mechanical lines ensuring the minimum of maintenance costs and upkeep. To-day many authorities are convinced of the reliability of the equipment and its ability to carry out the heavy work for which it is designed, and complete cooking installations are offered on extended-payment terms.

Where these terms are offered, together with an economical tariff commensurate with other competitive fuels, large business can be obtained. The tariff, however, whilst being as attractive as possible should be without restriction or standing charge on the cooking equipment itself. With the offer of a flat rate the consumer can more easily calculate his possible consumption and it enables him to be told before installation what the approximate consumption is likely to be, as records of many different types of installations are available. In some areas where many small catering establishments exist, the supply authorities offer simple hire terms for certain popular lines, such as double oven cookers, hot-cupboards and grills, and where the terms are reasonable many orders are being obtained from such premises.

Steam-electric Cooking

In some larger kitchens it often happens that a combination of steam and electric cooking equipment is proposed, and if live steam is available there is no doubt that this combination will provide the most economical form of cooking, steam being used for vegetable and soup boiling, steaming ovens and hot-cupboards. The capital cost, however, of such an installation will be greater than a complete electric cooking installation.

The design of suitable equipment for the commercial fish and chip frying business opens up a field which has great possibilities. The milk bar is another direction in which electricity can excel, the apparatus comprising milk and water urns, soup bain maries, toasters, waffle irons, etc. Some of this equipment is also used in snack bars, in addition to grillers, sausage and mash heaters, pie warmers, etc.

There are many directions in which electricity can be of more service to the hospital, even if it is not possible to obtain the main kitchen load. Food after being cooked has to be conveyed to the wards and electrically-heated food trolleys provide an hygienic and economical method (one mental hospital has installed nineteen electrically heated food trolleys.) In the ward kitchens themselves occasional meals have to be provided when the main kitchen is closed down, but in most cases a cooker, hot-cupboard and water urn would be installed. There are cases too numerous to mention where electricity will do the work better than, and as economically as, any other type of fuel.

An article of this description obviously cannot deal with the subject very fully; one of the most valuable contributions in recent years to the subject of large-scale electric cooking was the paper by Messrs. Hurry and Swale at the 1936 I.M.E.A. Convention.

Fish and Chips. By Dennis Bellamy, A.L.A.A., F.C.W.A.*

Great possibilities

IT is computed that there are in England to-day 35,000 fish-and-chip shops and as a conservative estimate 12,000,000 persons per day have one meal of fish and/or chips. These numbers are increasing year by year to form an organisation of communal cooked food distribution that is without parallel. It is also computed that 65 per cent. of the total fish landings and 75 per cent. of the English potato crop passes to the public *via* the fish-and-chip industry.

The pioneer in this business was John Rouse, a mill engineer, who made a range for cooking fish and chips in quantities, and from the cellar of his cottage in Oldham commenced the business of fish fryer cum range maker.

Modern industrialisation has increased the need a thousandfold, and modern range makers and fish fryers have arisen to fulfil the need. The fish-frying industry was built and developed on coal; later gas began to elbow its way in, demanding recognition and refusing to be denied. To-day electricity knocks loudly at the door, and it is of interest to study the attitude towards it of range makers, fish fryers and the electricity supply industry.

As regards the first two the position can be quickly stated. In 1926 there was only one range maker who listed an electric fish range as a standard product, and as a point of interest it was John Rouse (Oldham), Ltd. In 1937 there are five makers marketing electric ranges, and carrying on valuable propaganda work. In 1926 there was, as far as can be ascertained, one electric range actually in use, and by this year this number had increased to approximately 170.

It would seem in general that the electricity supply industry, in spite of the market for fuel to cook food for 12,000,000 people daily, has yet to appreciate fully the opportunity that is waiting, and that its knocking on the door has barely reached the ears of the fish fryers or its competitors who sit entrenched within. It may well be that the supply industry is awaiting the return of the first intrepid explorers to bring back news of the country beyond. Actually, there have been quite a few but their reports have been individual and have not indicated a land flowing with milk and honey, but the results now obtained by the Hull Electricity Department are of such magnitude as to give a fair estimate of the position and to remove entirely any uncertainty.

Experience at Hull shows that electricity gives excellent results in the production of these popular comestibles

It will be appreciated that the fish-frying industry is still the stronghold of the small man, and the multiple shop has made very little encroachment. But it should also be appreciated that contrary to popular conception it is not a way of making "easy money." Where dinner-time frying obtains and where fish is bought each day on the market the fryer works from 6 a.m. to midnight for six days per week with very short intervals for relaxation, and, as if this were not enough, his life has been harassed in recent years by the operation of the Potato Marketing Board and the fish quota, while to-day the fryer awaits with some anxiety the effect of the Fishing Industry Bill. It is important that this should be appreciated. The method of approach must be essentially of a personal nature. It is not surprising that the fryer has no time or inclination for official correspondence or formalities. A representative must not be dismayed or offended at preliminary rebuffs for when he has once convinced the fryer of his honest purpose and gained his confidence he will find him in every way a fine fellow. This personal contact must remain during every phase of the installation of a range and afterwards. In Hull after the installation of a range contact is maintained daily for a week, and thereafter at weekly intervals, gradually lengthening to an occasional call by the representative who handled the business.

The possibilities of the market depend fundamentally on the tariff or cost of fuel as the operation and performance of the range is now established beyond dispute. The tariff should be as simple as possible, preferably a flat rate, and due to the normal operation of the trade it is possible to effect generation peak restriction without imposing any hardship. The present tariff in Hull is ¼d. per kWh with the following hours of restriction :—

November (14th to 30th)	4.15 p.m. to 5.30 p.m.
December	3.45 p.m. to 5.30 p.m.
January	4.15 p.m. to 5.30 p.m.

* Deputy commercial manager, Hull Corporation Electricity Department.

It is not claimed that this is the only tariff at which fish frying is an economic proposition as it can be demonstrated that a higher unit charge can still show an advantage against other fuels, but this can be determined from the data of running costs available in conjunction with the local costs of competitive fuels.

At the moment there are twenty electric ranges installed in Hull of which three were installed in new shops, six displaced gas, and eleven displaced coal. Specimen running costs are given in the table below with electricity at ½d. per kWh. These are based on the cost of fuel per £1 of takings which is the accepted criterion in the trade. The figures given are average figures over twelve months' continuous working and covering the usual fluctuation of seasonal trade. Apart from this, records are available where figures as low as 5.2d. per £1 of takings have been obtained for periods of two or three months, and it is confidently anticipated that the annual figures at present used will be improved upon.

	Trade per week.	District.	Cost per £1 of takings.
Case A	£31	Suburban	6.60d.
Case B	£38	Suburban	6.52d.
Case C	£35	Working-class	6.90d.
Case D	£34	Working-class	6.9½d.

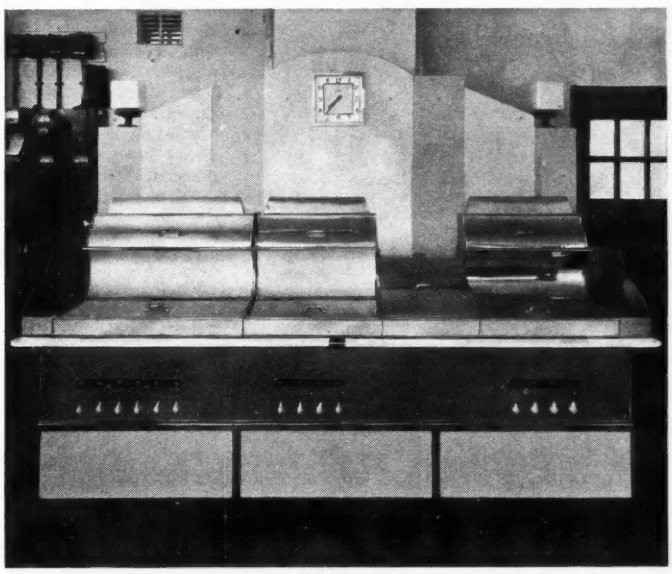
Quoting the experience of the fryers who up to the time of conversion used gas at 7½d. per therm the comparison in the above two classes of district is approximately 11d. and 1s. respectively. Coal may be taken as an average of 4d. per £1 of takings, while coke breeze will vary from a figure slightly below coal to a figure equivalent to electricity, depending largely upon the manipulation of the range by the individual fryer.

There are two other factors to be considered in relation to running cost. One is the saving of fat due to efficient control of heat as against coal or coke breeze, and this can amount to as much as 15s. per week. The other is the life of the pans and consequent renewal. With an electric range the life of the pan is the life of the range, but with combustible fuel the life is limited and as an average may be taken to be: gas six years, coal three years, breeze two or three years.

Apart from running costs the electric range can make a unique claim on its special features. Its cleanliness and hygiene places it in the forefront and enables it to be installed in town-planning areas where there is restriction on other fuels. In ease of operation, flexibility, cleanliness, time of reaching cooking temperature from cold and speed of recovery the electric range can be confidently put forward to compete successfully with its competitors.

Since the Hull Electricity Department first invaded the fish frying market the range has been modified and improved in conjunction with the manufacturers, John Rouse (Oldham), Ltd., and the early difficulties have been finally overcome so that the electric range is no longer an experiment but a standard piece of apparatus. In practically every case where an electric range has been installed an increased turnover has been reported.

A sales survey of all the fish-frying shops in Hull revealed the fact that 20 per cent. formed a potential market for electric ranges in the first instance. Using this as a basis for the country there is a market for 7,000 ranges. Results have shown that the minimum average annual consumption is 30,000 kWh, so that a national consumption of 210,000,000 kWh per annum is possible. Apart from this, in practically every case the fryer has been persuaded to improve his lighting and to install domestic cookers, washboilers, fires and water heaters. In every case an electric potato peeler is in operation. It is not possible to assess the effect of the publicity value to the electrical industry, but it must be very considerable. The range must be made available on attractive hire-purchase terms and the service and maintenance arrangements must be effective.



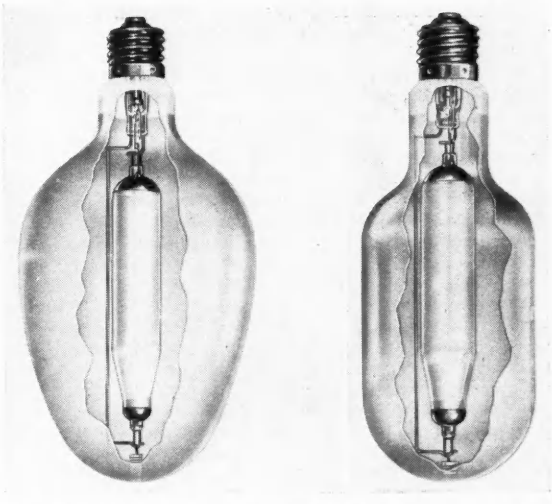
One of the Hull fish-and-chip ranges

Fluorescent Coated Discharge Lamps

THE mercury vapour electric discharge lamp, while having a high light output (about 45 lumens per watt) suffers under the disability of a deficiency of red rays, the proportion being normally only 1 per cent. The addition of cadmium and zinc to the mercury in the inner tube increases the red rays to 2½ per cent. but lowers the efficiency to 37 lumens per watt; combination with a tungsten filament gives a still lower overall efficiency—25 lumens per watt—but a red content of 8 per cent. The fluorescent lamp put on the market this week brings the efficiency up to 38 lumens per watt with a red light content of between 5 and 6 per cent.

In this lamp the standard type of mercury inner tube is enclosed in a larger outer bulb than is usual, measuring 330 mm. long and 165 mm. in diameter and oval in shape. The interior of this bulb is coated with a powder which becomes fluorescent under the action of ultra-violet light emitted by the discharge lamp and brings about a change in wavelength of the ultra-violet light, bringing it into the visible range, some of which is in the red region.

The outer bulb of the fluorescent lamp has necessarily to be of considerably larger diameter than the standard type as overheating of the powder on the outer casing would cause loss of efficiency through its life. The coating creates a diffusion of light to such an extent that this bulb becomes in effect the light source, presenting a difficult problem in light control, as the standard type of electric discharge lantern is designed to focus only over a comparatively narrow band of light. For this reason a special tubular shaped fluorescent lamp is available for street lighting lanterns which will not accommodate the larger "iso-thermal" bulb. The efficiency, however, will not be so high as that of the larger type. These lamps are made by the British Thomson-Houston Co., Ltd., Crompton Parkinson, Ltd., Edison Swan Electric Co., Ltd., General Electric Co., Ltd., Metropolitan-Vickers Electrical Co., Ltd., Philips Lamps, Ltd., and Siemens Electric Lamps and Supplies, Ltd.



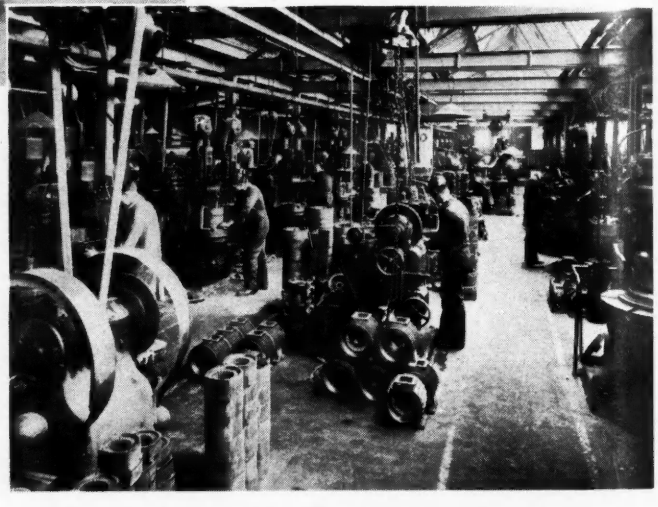
The 400-W fluorescent lamp: The iso-thermal bulb, and (right) the tubular bulb

Making Food Preparation Machinery

A self-contained factory at Willesden

How a well-known motor manufacturing company has, in four years, built up a profitable new section

ALTHOUGH it has been in operation only just over four years the new Speciality Machine Section of Lancashire Dynamo and Crypto, Ltd., is now producing in large quantities nearly thirty different types of food preparation machinery. To accomplish this and at the same time cater for the rapidly increasing demand for small electric motors it has been necessary to more than double the floor area of the Acton Lane, Willesden, factory. With the facilities now available the company claims to be the only one in this country manufacturing this type of apparatus in its entirety.



Above: A view of an assembly shop in the Crypto Food Machinery Section showing cake mixers (left), potato peelers (centre) and chip cutters (left background). Right: A part of the machine shop

Having over thirty years' experience in electric motor production to its credit the company has had little to learn on the electrical side of its new enterprise. The ⅛ to 3-h.p. motors employed are more or less standard lines, modified in some cases, but produced in the normal routine of the original factory. In fact, the only effects noticeable in the motor department since the manufacture of the new apparatus commenced have been a general expansion of all sections and a much improved and more constant output.

The whole factory gives employment to over 700 people and there are besides over 1,300 employed at the company's Trafford Park, Manchester, factory.

The range of food preparation equipment produced at Willesden covers such articles as mincers, cutters, combination mincers and bowl cutters, sausage machines, coffee and spice grinders, vegetable peelers and cutters, automatic potato chip cutters, and mixers with various attachments. In addition, an electric hand dryer is made.

The Gear-cutting Shop

Apart from the metal castings, the whole of the manufacturing processes, as well as the construction of most of the necessary tools, are carried out in this one factory. All the helical and worm gears are cut from solid steel bars, and nothing less than 40-ton tensile steel is employed, "Firthag" being used to a large extent. Every gear is tested to a 0.002 in. by means of a Maar apparatus. Ball and roller bearings are employed very extensively and the general adoption of oil bath lubrication does away with oiling difficulties. Since the company commenced the manufacture of food preparation machinery the gear-cutting room has been extended to three times its original size.

As a very large proportion of the metal working machinery for drilling, machining, &c., is in almost constant operation the majority of the heavier apparatus is belt driven from centrally situated electric motors, local self-contained electric drives being utilised, however, for certain processes. Considerable expenditure has recently been incurred on bringing the factory up-to-date and a large amount of automatic machinery has been installed.

Very stringent tests are carried out before apparatus is passed. Every mixer, for example, is subjected to a two-hours' test in paint sludge at all its three speeds. Special attention is paid to finish and all apparatus after rubbing down by hand is given ten coats of cellulose paint.

The company does not believe in standing still and Mr. W. G. Swain, the sales manager, told us during a recent visit that there had not been a single period in the history of the new section when some new model had not been "on the stocks." As evidence of this we were shown a new 7-lb capacity potato peeler shortly to be placed on the market. Like other of the company's models, this peeler incorporates an abrasive claimed to save 10 per cent. of waste as compared with other makes.

As indications of the savings in materials and time that can be effected by the use of the various appliances we were told that whereas with hand peeling as much as one-third of the weight of potatoes can be lost only about 5 per cent. is removed by Crypto machines. With regard to mixers, the work can be done in approximately one-third of the time taken by hand. Push-button control is employed on all the large machines and wherever safety demands it electrical interlocks are included. In deciding upon designs care has been taken to ensure compactness.

The company's Speciality Machine Section is a completely separate entity from the industrial side, and it markets through its own organisation direct to users only. Prospective purchasers can take advantage of a trade advisory department, the staff of which includes a trained chef, pastrycook and baker. Already a very large number of hotels, stores, restaurants, hospitals, &c., as well as the Admiralty, Army and the Air Force, are using the machines. In addition the company has supplied food preparing machinery to many co-operative societies and also local administrative bodies, holiday camps and industrial canteens. Furthermore it is making good progress in the general kitchen trade.

Transport Congress

In view of the period previously selected clashing with that chosen by the Municipal Tramways and Transport Association for its annual conference, the Tramways, Light Railways and Transport Association is holding its annual congress at Folkestone from June 8th to 11th instead of 22nd to 25th.

Restaurant Cooking

A twelve-year-old system modernised

An installation which has given satisfaction to clientele, management and chef

BY the courtesy of Peter Robinson, Ltd., we are able to show how by electric cooking they have added to the service to their clientele at their Oxford Street establishment with satisfaction to the management on the score of economy, to the chef because of the flexibility of operation and aid to first-class cooking, and to the engineer on account of low maintenance cost.

In the large restaurant, which will seat 600, and the "Opera Room," with a seating capacity of 400, from 600 to 900 lunches are served daily and roughly the same number of teas. All told, from 1,000 to 2,000 persons take some form of refreshment every day, that is, lunches and teas, morning coffee, and light meals.

Apart from boiling vegetables in bulk, hams and stock-pot soups by steam, the whole of the cooking requirements for the restaurants are catered for by the installation, which is designed to deal with soups, roasts, fish, sauces, frys and grills, omelettes and toasts, puddings, cakes and pastries. The total consumption of the whole of the equipment during 1936 was 216,820 kWh for 52 weeks of 5½ days, less holidays.

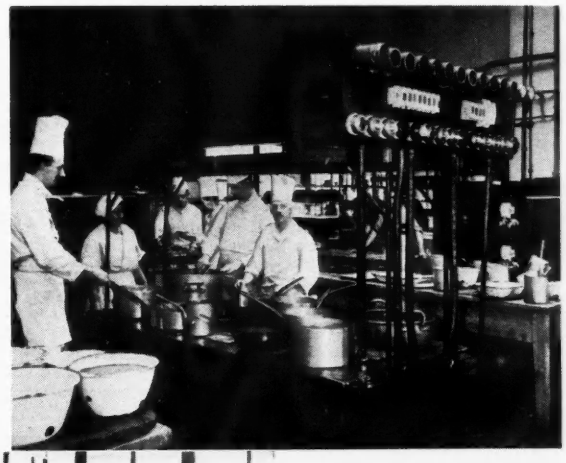
There are two vertical two-compartment roasting ovens, each compartment being loaded at 4.9 kW. Separate switching is employed for each compartment, the elements being arranged in two circuits controlled by three-heat switches. Bar-type open elements with shields are arranged for side heating only. These ovens will take joints up to 50 lb. and they are also used for braising meats and vegetables.

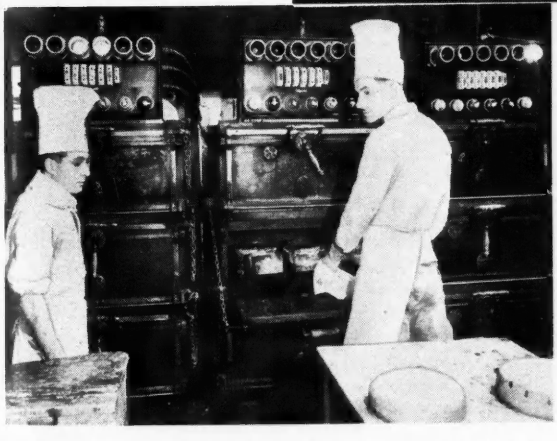
Of the three combined hot cupboard and grilling equipments, one which is used for steaks and bacon has two side-by-side grilling compartments. The total loading of the equipment is 9.6 kW, the large compartment being served by two direct "on" and "off" switches, while the small compartment has three-heat control. The reason for this is that definite grilling operations in the large compartment demand the heating "all out," while in the other compartment three-heat control provides a finer regulation for browning and warming. The hot-cupboard is arranged immediately above the grilling section, from which it utilises "waste heat."

For preparing **gratin** fish and grilling and glazing fish there is a similar equipment, while the third unit of the bank, which is used for toasting crumpets and bread, is of the same loading and construction, although the toasting chamber is only 5 in. high because the heat is required nearer the bread. The switching arrangements for the last two equipments are the same as for the first.

A three-pan fish fryer has a total loading of 19.2 kW. The elements are arranged in trays under the pans, so that they can be withdrawn for easy cleaning. Mr. J. Swan, the chief electrician, spoke highly of this arrangement because the complete element units can be taken immediately right away from the kitchen for treatment by the mechanics. Each tray has two switches, one single-heat and one three-heat, to give an overall four-heat control with any one heat evenly distributed over the bottom of the pan.

A large boiling table is equipped with sixteen 12 in. by 8 in. 2,500-W domestic-cooker type hot-plates. Twelve of these plates are separately three-heat switch controlled. The other four are arranged as two banks of two plates, or, in effect, two 12-in. by 16-in. plates, each with three-heat control and loaded at 5,000 W. These larger units have replaced the original incorporated bains-marie purely to accommodate larger utensils. There is also an eight-plate boiling table which measures 5 ft. 10 in. long, 2 ft. 2 in. wide and 2 ft. 5 in. high. The plates are of the same type as those in the larger unit and they are all housed and operated separately.





Above: The large boiling table, bank of grilling equipments (left) and roasting ovens (right). Left: The fish fryer. Below: The bank of pastry ovens

We congratulate the Peter Robinson engineers on the omelette stove of their own construction. It has four 8 in. by 6 in. 1,200-W plates arranged as one rectangular unit in an angle-iron frame providing a table top measuring 14 in. wide by 18 in. long. Each pair of plates at opposite corners of the rectangle is controlled as one unit by a three-heat switch. This facilitates the dual operations of boiling and stirring in two pans simultaneously. Another unit installed in the kitchen has two 8 in. by 6 in. plates with overall three-heat control and is for keeping vegetables hot.

A large service hot-cupboard is used for warming plates, &c. The total loading is 7 kW.

All the cakes and pastries and fancy rolls consumed in the restaurant are produced by a bank of three pastry ovens, each oven having three compartments in tier formation. Each compartment measures 28 in. by 22 in. by 14 in. and has a loading of 2.88 kW. This is distributed equally between top and bottom and for each heating section control is divided between two circuits, each governed by a three-heat switch. The whole of the equipment, with the exception of those smaller items constructed by the engineering department, was supplied by the Jackson Electric Stove Co., Ltd., and installed by Duncan Watson & Co., Ltd.

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Non-statutory Undertakings.

By G. V. Harrap

Powers, duties and restrictions

FOLLOWING upon recent inquiries into the structure of the electricity supply industry, attention has been turned to the conditions under which electricity undertakings operate. Much has been written upon the subject of authorised undertakings, but there appears to be little having a direct bearing on non-statutory undertakings. There are a number of decided cases dealing with this type and it will be found that the standard text books, etc., do contain a small amount of matter devoted to the conditions of operation.

The most serious impediment against obtaining a clear idea of these conditions is the fact that references to them are so scattered, and search has to be made through the various public and private Acts of Parliament and Electricity Commissioners' Regulations. In this article I attempt to explain the differences between authorised and unauthorised (or non-statutory) undertakings. Where no comment is made upon any particular duty or restriction, it is to be assumed that the non-statutory undertaker has a similar duty or restriction. References to Acts and sections thereof are to be taken as being to the Electricity (Supply) Acts, 1882-1935, unless otherwise stated.

The author has brought together from a number of sources useful information on a somewhat obscure subject

Power to Supply

Non-statutory undertakings can only be operated by persons or companies, since the powers conferred upon a local authority by the 1882 Act, Sec. 8, in respect of borrowing money for electricity purposes, are only exercisable by local authorities who are authorised undertakers. It is permissible for any person or company to supply for public and private purposes, *i.e.*, operate a non-statutory undertaking, in any area outside that of an authorised undertaker. Prior to 1909 it was possible for a non-statutory undertaker to commence operations within the area of supply of an authorised undertaker, but by Sec. 23 of the Act of that year, this is now unlawful. The commencement of such a supply cannot now be undertaken, although the Section does not prohibit the continuance of an existing undertaking. There is a saving clause to the effect that the prohibition against affording a supply is not to prevent any person or company whose business is not primarily that of electricity supply, from affording supplies to any other person or company. (See Caerphilly U.D.C. *v.* Griffin.) Supplies are given under this provision by colliery and steel companies, etc., who use waste heat to generate electricity for their own purposes, and sell any surplus.

It must not be assumed that non-statutory undertakings operating under the above-mentioned saving clause can only give isolated supplies to persons and companies. Supplies are given to groups of consumers, both industrial and domestic, and to local authorities. It was mentioned in evidence before the Committee on Electricity Distribution, that within the area of one large authorised undertaker, there were no fewer than 32 non-statutory undertakings supplying 29,000 consumers and some 5,000 public lamps. Supplies are also given for pumping and sewage works and other public purposes.

A second proviso to the 1909 Act, Sec. 23, exempts companies who, at the passing of the Act, were empowered by their memoranda of association to generate electrical energy, whether they had exercised such powers or not. It is interesting to note in this connection that a company incorporated under the Companies (Consolidation) Act, 1908, may by special resolution alter the provisions of its memorandum of association with respect to the objects of the company so far as may be required for any of the purposes thereinafter specified (S.9 (1)). One of the purposes specified is " to carry on some business which under existing circumstances may conveniently or advantageously be combined with the business of the company." Applications have been successfully made to the Courts to confirm special resolutions to enable gas, water, telephone, and tramway companies to supply electricity. A non-statutory undertaking could obtain powers in this way, although, being non-statutory, it could not supply within the area of an undertaking already authorised (1909 Act, Sec. 23).

An authorised undertaker's area of supply may be extended so as to include the area of a non-statutory undertaker, but the continuance and extension of supply by the latter does not thereby become illegal. The former cannot take over the latter undertaking and run the two concerns as separate entities. (See Att.-Gen. *v.* Southport Corporation.) See also the 1899 Act, Sec. 4 (2).

Non-statutory undertakers can enter into arrangements for giving bulk supplies to the Central Electricity Board (1926 Act, Sec. 23), to joint electricity authorities (1919 Act, Sec. 15 (2)) and to other authorised undertakers (1922 Act, Sec. 13 (b)). Power to break up streets and to do other things necessary for the giving of such supplies is withheld from non-statutory undertakers, and such work must be carried out by the authorised undertaker to whom the supply is given (1909 Act, Sec. 3, and 1919 Act, Sec. 32 (3)).

Distribution Lines

An authorised undertaking has a general power given to it by the Special or other Order under which it is constituted, to break up streets for the purpose of public and private supplies. (1899 Act, Sec. 11, and Gasworks (Clauses) Act, 1847, Sec. 6, 7, 8, 9, 10, 11 and 12). Since the non-statutory undertaking does not operate under an Order, such general authority cannot be given. It has, therefore, to obtain specific authority and sanction from the local authority, urban, rural, or county council within whose area the supply is given. Such sanction can be obtained from the local authority under Sec. 161 of the Public Health Act, 1875, especially if a contract is entered into for the lighting of the streets under the Lighting and Watching Act, 1833. A particularly important reference in this connection, showing the rebuttal of an objection by an owner of land, is given in Fareham Local Board and Fareham Electric Lighting Co. *v.* Smith.

The breaking-up of public streets without authority is a common law nuisance, and hence it will be found that many non-statutory undertakers give supplies by overhead lines. If possible such an undertaker endeavours to erect the lines outside the jurisdiction of the local authority for the area. (See Finchley Electric Light Co., Ltd. *v.* Finchley U.D.C.). Several corporations have obtained in special Acts provisions prohibiting the erection of such wires without their consent, or enabling them to deal with overhead lines. (See, *e.g.*, Manchester Corporation Act, 1882.)

Even with overhead lines, limitations are imposed upon these undertakers, for the placing of poles anywhere between the fences or boundaries of a public highway is an indictable nuisance if done without authority. (See Rex *v.* United Kingdom Telegraph Co.) Furthermore, the consent of the road authority constituted under the Highway Act, 1835, will not legalise what would have otherwise been a public nuisance. (See Att.-Gen. *v.* Barker.)

Extensions and New Stations

The extension of existing generating stations or the establishment of new generating stations by non-statutory undertakers whose main purpose is the public supply of electricity, are subject to the supervision of the Electricity Commissioners (1919 Act, Sec. 11; 1909 Act, Sec. 2; S. R. & O. 1930, No. 102,

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Restaurant Cooking (*Concluded from previous page*)

The equipment has been modified slightly from time to time to bring it more in line with modern constructional practice in two ways. First, as the result of overcoming definite troubles, and, secondly, by taking advantage of opportunities offered for modernisation as and when renewals have been required.

The larger boiling table originally had 8 in. by 6 in. solid-top open-element plates, which were replaced by those mentioned because of troubles caused by liquid-food spillage and creepage. The embedded plates are giving entire satisfaction. The roasting ovens at first had elements constructed with ribbon resistor wound on mica. As normal deterioration took place these were replaced by elements constructed of nickel-chrome spirals on porcelain formers.

The pastry-oven elements have been converted in exactly the same way, although it was emphasised that there has been no question of maintenance trouble with the ovens right from the start. Considerable trouble was experienced with the switches of the grilling and toasting equipments when they were situated under the grilling compartments and therefore fairly near the elements. They became very hard to turn. Such troubles have been entirely eliminated by fixing the switches on frames at the ends of the equipments away from the heat.

Rule V. and Schd. B.). This supervision does not extend to private generating stations used mainly for purposes other than the public supply of electricity (1909 Act, Sec. 11), which are covered by the various Public Health Acts.

Non-statutory undertakers have no power to alter the position of pipes and other lines, etc. (See 1882 Act, Sec. 15, for powers granted to authorised undertakers.) It is of interest to note that in the Acts or Orders authorising the construction of tramways, a special clause is inserted providing that "nothing in this Act (or Order) shall authorise any interference with electric lines and works of any undertakers under the Electric Lighting Acts, 1882-1935, to which the provisions of Sec. 15 of the former Act apply except in accordance with and subject to the provisions of that Section." (See Model Bill and Clauses, 1923, House of Lords.) This means that the lines and works of a non-statutory undertaker do not enjoy any special protection from interference by such authorities.

The type of undertaking under discussion is liable to indictment, restraint, granting of an injunction, etc., for nuisance in the event of such being caused by it in operating a generating station. (See 1899 Act, Sec. 81; Public Health (London) Act, 1891, Sec. 24 (b); Joint Select Committee on Electrical Energy, Generating Stations and Supply, 1898; and Joint Select Committee on Electric Powers Protective Clauses, 1893). Non-statutory undertakers do not enjoy the saving conditions granted by the 1919 Act, Sec. 10, whereby authorised undertakers are not liable for any nuisance caused by them in operating a generating station, unless they have been negligent.

These undertakers are also open to restraint, injunctions, and actions for trespass by various authorities and landowners. (See St. Mary Vestry (Battersea) *v.* County of London and Brush Provincial Electric Supply Co.). It should be noted, however, that the Courts have generally declined to grant an injunction where the inconvenience to the public is of a trivial or temporary nature. (See Att.-Gen. *v.* Sheffield Gas Consumers' Co.).

An ameliorating feature of some interest, is the fact that lines of non-statutory undertakers have received protection as though authorised, in certain cases. (See East Notts. Electricity Special Order, 1928, Sec. 11, and South Yorks and Derbyshire Gas Act, 1930, Sec. 93.)

Obligations and Regulations

In general a non-statutory undertaker is under no obligation to lay down suitable and sufficient mains for the purpose of a general supply. nor to maintain a regular, sufficient, and continuous supply at a declared pressure. Such an undertaker is not subject to specified maximum charges, but has no power for the summary recovery of outstanding accounts. (See in this connection the Gasworks Clauses Act, 1947, Sec. 40, the Railway Clauses Consolidation Act, 1845, Sec. 140-160, the Railway Clauses Consolidation (Scotland) Act, 1845, and the Electricity (Supply) Act, 1899, Sec. 76). It has also no power to compulsorily acquire land or wayleaves.

Both overhead and underground lines belonging to non-statutory undertakers may be subjected to the Regulations of the Electricity Commissioners, and Sec. 4 (1) of the 1888 Act, specifically brings lines and works used for the supply of electricity, which have been laid down without statutory authority, under the control of the Electricity Commissioners. Regulations have in fact been made under this Section, but non-statutory undertakers cannot assume from the fact that these Regulations have been made for their lines and works, that the breakage of streets is thereby authorised. (See 1882 Act, Sec. 6). When the Electricity Commissioners hear or are informed of the erection or use of any electric lines or works erected or used in the manner described in the 1888 Act, Sec. 4, a notice is served upon the non-statutory undertaker.

Most electricity supply engineers are familiar with the provisions of the Electricity Supply Regulations, 1937, for securing the safety of the public and for ensuring a proper and sufficient supply of electrical energy. Engineers are not, however, so familiar with the Regulations made under the 1888 Act, Sec. 4, for observance by non-statutory undertakers.

In addition to these Regulations, an urban or rural district council which adopts Part II of the Public Health Amendment Act, 1890, Sec. 3 and 5, may make by-laws regulating the conditions under which overhead lines, etc., may be erected within the areas under their jurisdiction. Such by-laws are only applicable to non-statutory undertakers. Within London, the L.C.C. by-laws made on July 29th, 1892, and June 22nd, 1923, under the London Overhead Wires Act, 1891, are operative upon any non-statutory undertaker's lines.

The Home Office Regulations under the Factory and Workshops Acts, 1901-1937, are applicable to these undertakers, and protection is also given to the Postmaster-General for the safeguarding of his apparatus in like manner to that imposed on authorised undertakers. (See 1888 Act, Sec. 4 (2); Sec. 8 of the Regulations made under the 1888 Act; 1882 Act, Sec. 26; and Telegraph Acts, 1863-1897.)

Incorporated companies operating non-statutory undertakings are subject to the provisions of the Companies Acts, and are able to sue and be sued for negligence, damage to property, and persons, and actions lie against them for the negligence of contractors where such are employed to carry out work. (See Ellis v. Sheffield Gas Consumers' Co.) Persons, partnerships, and private companies operating this type of undertaking have all the privileges and limitations usual with such types of business.

McGowan Committee's Recommendations

As a conclusion to this short article, the recommendations of the Committee on Electricity Distribution as contained in paragraphs 456 and 457 of its Report are contrasted with a statement of the work and benefits carried out by non-statutory undertakers in the past. Before doing this, Section 23 of the 1909 Act is set out in full because of its importance, and from the fact that it is continually referred to, both above, and in the following remarks:—

> "Where in any area a local authority, company, or person is authorised to supply electricity under Act of Parliament or under licence or Provisional Order granted under the Electric Lighting Acts, it shall not, after the passing of this Act, be lawful for any other local authority, company or person to commence to supply or distribute electricity within the same area unless such supply or distribution is authorised by Act of Parliament, or by licence or Provisional Order granted in terms of the Electric Lighting Acts; provided that this section shall not prevent any company or person affording a supply of electrical energy to any other company or person where the business of the company or person affording the supply is not primarily that of the supply of electrical energy to consumers;
>
> "Provided also that this section shall not prevent any company who at the passing of this Act are empowered by their memorandum of association to generate electrical energy from affording a supply to a railway company for purposes incidental to that company's undertaking other than the conveyance of public traffic."

The McGowan Committee recommended that the provisions of the above Section should be strengthened. It suggested that "No unauthorised supply to new consumers should in future be allowed in the area of an authorised distributor without the consent of that distributor. But the consent must not be unreasonably withheld, and there should be an appeal to the Electricity Commissioners, who should have power in appropriate circumstances of dispensing with the authorised distributor's consent if they are satisfied that it is in the public interest so to do."

A further suggestion was made to the effect that "provision might be made whereby, without prejudice to their statutory rights of supply, authorised distributors should be entitled to take over the electric lines and other works of any non-statutory supplier within their area on the basis of capital expenditure less depreciation. Such power should, however, only be exercised with the consent of the Electricity Commissioners, and only in cases where the Commissioners are satisfied that no undue hardship will be imposed on the consumers concerned as a result of the transfer."

A Non-statutory Undertaking's Views

It is interesting to place against this a statement by the secretary of an important non-statutory undertaking (a colliery company):—

> "Although everything possible is being done at the present time to ensure that non-statutory undertakings do not interfere with the business of statutory undertakings, it has long been felt that some non-statutory undertakings should be allowed preferential treatment as regards their supplies to outside consumers.
>
> "In the first place, they have been giving supplies for many years in districts where statutory undertakings did not develop because they did not consider the return on the expenditure involved sufficient to allow them to afford supplies. Non-statutory undertakings, in these cases, have met a public need, which should be recognised. It seems unreasonable that, after spending money to provide these supplies they should be called upon to discontinue them in order that the statutory undertakings should reap the benefit of their pioneer work at a time when the undertaking may have developed sufficiently to show some profit to the suppliers. Many of the industrial undertakings, affording supplies for domestic purposes and bulk supplies to local authorities, are able to give these supplies at very reasonable rates owing to the diversity factor of their own demand and the domestic demand. Again, it has very often been the policy of industrial concerns to supply electricity to houses owned by them at low charges merely as an additional social service to their employés.
>
> "A colliery company is, of course, in a very good position to afford energy to outside consumers, as its costs for the generation of power should be less than that of the majority of statutory undertakings for the following reasons: 1. The power stations are situated on the surface of a colliery so that the freightage on incoming coal is a minimum. 2. Distribution charges are low because the station is usually in the centre of gravity of the consumers. 3. Rents are lower than in the towns. 4. The diversity factor of the colliery load and the outside consumer is high.
>
> "Taking these very important points into consideration, it would seem that the continuation of supplies from non-statutory undertakings can only be of benefit to the public."

Visibility in Fog. By W. S. Stiles, Ph.D.

The use of coloured light

MANY motorists believe that by fitting colour screens over their headlights to obtain a yellow, orange or amber beam they are able to see better in fog. They probably attribute the advantage they think they obtain to a greater penetrating power of the coloured light compared with white or to a reduction in the light scattered back into the driver's eyes by the fog. As the penetrating power and amount of scattering of different coloured lights in fog can be measured scientific evidence for or against the alleged advantages of coloured light should be obtainable. In reality, the problem is less simple than might appear because the properties of the eye are involved as well as the properties of the fog.

The rays of light issuing from a headlight in fog are progressively reduced in intensity as they travel through the atmosphere. If the intensity at a particular distance, let us say 100 ft., from the headlight equals a fraction t of the initial intensity, then t represents the transmission of the atmosphere over 100 ft. and is a measure of the penetrating power of the light emitted. Two things may happen to the fraction $(1-t)$ of the light which is lost from the beam. The light rays may be scattered in all directions by the particles of the fog, thereby causing the fog itself to become luminous. This has two main effects: (*a*) The illuminated fog lying beyond the object which the driver wishes to see serves to increase the brightness of the background. In most cases objects in headlight beams are seen brighter than the background. It follows that an increase in the brightness of the background will make object and background more nearly equal in brightness and the visibility of the object will be reduced. (b) The layer of illuminated fog lying between the driver and the object acts a "veiling" brightness. As the veiling brightness is added both to the brightness of the object and the brightness of the background, it reduces their *relative* difference of brightness and thereby reduces the visibility of the object.

In the course of his article Dr. Stiles refers to investigations in England, Holland and France

On the other hand, the particles of fog may absorb the light rays, converting them into heat. Rays so absorbed are of no further value in revealing objects in the headlight beam, but unlike the scattered rays they can have no adverse effect on visibility. The visibility of objects in the beam for a given value of transmission of the atmosphere must, therefore, depend on how the light losses are distributed between scattering and true absorption.

Hypothetical Atmospheres

When a colour filter is placed over the headlight in a hypothetical atmosphere which absorbs but does not scatter the light its use cannot be expected to improve visibility even though the penetrating power of light of the colour transmitted by the filter may greatly exceed that of light of the colour absorbed by the filter. In the optimum case the colour filter would merely remove, at the headlight, rays which would in any case be absorbed by the atmosphere.

Taking the opposite extreme of an atmosphere which simply scatters the light without absorption, let us suppose again as an extreme case never realised in practice that it is only the "blue half" of the spectrum which is subject to scattering. With a white headlight the illumination and apparent brightness of the object will be relatively red, the background brightness will be relatively blue, while the veiling brightness which arises solely from scattered light will be completely blue. If now a colour filter which absorbs the blue and transmits the red is inserted at the headlight, the apparent brightness of the object will be reduced in a less proportion than the background brightness and the veiling brightness will be completely eliminated. Both these efforts increase the brightness contrast presented by the object, and in these circumstances we may expect improved visibility by the use of the filter.

So far our considerations have tacitly assumed that the ratio of the physical brightnesses of object and background determines the visibility. It must be remembered, however, that the perception of the physical brightness contrast by the eye is the deciding factor. We know, for example, that the visibility of an object having a fixed brightness ratio with its background diminishes as the absolute brightnesses of object and background are reduced. Since the use of a colour filter must always produce some reduction in absolute brightnesses, the corresponding loss of visibility must be set against any gain due to a favourable change in the relative brightnesses. We must also consider the possibility that the eye is more sensitive to light of one colour than of another. Classic masurements by two German investigators (Kŏnig and Brodhun) have shown that at moderate brightnesses the eye is equally sensitive to brightness contrasts of all colours, including white, but that at low brightnesses (less than about 0.3 c. per sq. ft.) the sensitivity is greater for green and blue light than for red, yellow or orange, white light occupying an intermediate position.

It follows from the foregoing that if we are to make deductions about the value of colour filters from measurements of the penetrating power of lights of different colours we must also take into account the relative amounts of scattering and true absorption and the variation of eye sensitivity with colour and brightness level. We must also know how to combine the information on these various points to yield a conclusion applicable to the practical case, a by no means easy task. In recent years these difficulties have been largely evaded by direct comparisons of the range of visibility of objects in white and coloured headlight beams during fog. Three investigations on these lines have been carried out in England, Holland and France, respectively.

White and Coloured Beam Comparisons

In the first investigation, carried out at the National Physical Laboratory in 1933-4,* the experimental arrangements were as follows: An observer posted behind two headlights in the position of a car driver viewed the road ahead, through a very wide angle spectacle frame into which various colour filters could be inserted. Under the conditions of the experiments the effect of placing colour filters over the driver's eyes must be the same as that of placing similar filters over the headlights. A wooden test object painted a neutral grey was placed on the road at different distances from the headlights by an assistant until the position was found at which the object appeared on the limit of visibility to the observer, the distance of the object when this occurred being termed the *range*. This was done in the absence of any filters in the spectacle frame, so that the ordinary white light of the headlights was used, and with red, dark orange, light orange and blue-green filters inserted in turn in the spectacle frame. In addition, measurements were made with various neutral filters which reduced the intensity of the light without changing its colour. The object of using neutral filters was to see whether any change in the range of visibility which might be obtained with the colour filters arose merely from the reduction of intensity produced by the colour filters rather than from a specific colour effect.

From the results the value of the range ratio σ was calculated for each filter, σ being defined as the ratio of the range with the filter to the range with no filter. While the range measurements were in progress other assistants were determining the transmission of the fog over the same stretch of road. These measurements were used to correct the range observations for variations in the density of the fog during a comparison of the different filters and they also served to define in a scientific manner the degree of fog existing at the time of the experiments. The observations included very light fog in which the atmospheric transmission over 100 ft. equalled 87 per cent. and thick fog in which the corresponding transmission was as low as 0.0025 per cent.

The main results of this work are apparent from figures showing the variation of range ratio with filter transmission. In the diagram on the next page (c) shows this variation for lighter fogs (transmission per 100 ft. about 80 per cent.) and (a) and (b) for the thicker fogs. The filter transmission here in question is the total transmission for light of all wavelengths when the incident light is the white light emitted by the headlights. The range observations using no filters may be regarded as corresponding to a neutral filter transmission of 100 per cent. and are included in the figures on this basis. The curves have been drawn to fit as nearly as possible the values of the range ratio for the neutral filters. (The points marked A, B, C and D correspond to neutral filters.)

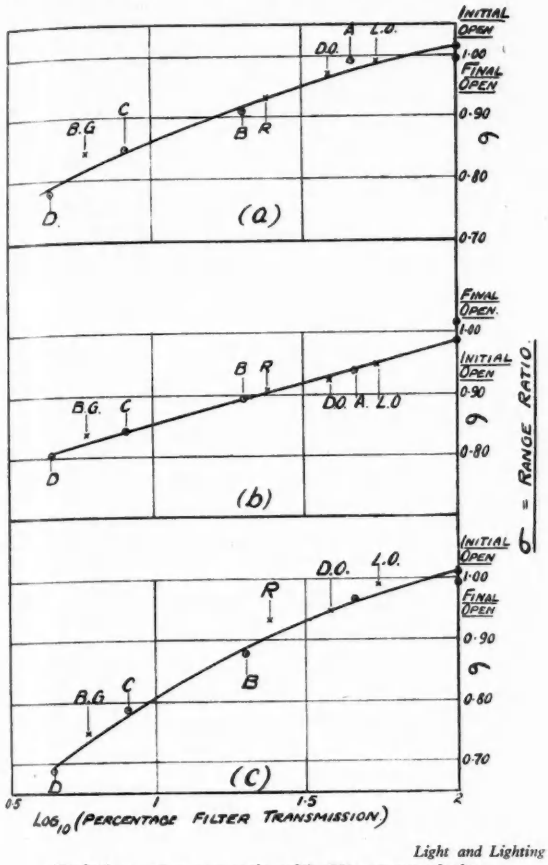
An examination of these figures enables the following conclusions to be drawn: (i) The effect of a colour filter on range is the same as that of a neutral filter of the same transmission. This follows from the fact that the points for the colour filters lie within the experimental error on the curve drawn through

* Stiles, *Illuminating Engineer* (now *Light and Lighting*), Oct., 1934, and April, 1935.

the points for the neutral filters. (ii) If a colour filter or a neutral filter has any appreciable effect on range it is always in the direction of a decrease.

Thus this investigation indicates clearly that no increase in range is to be obtained by the use of a colour filter. It also traverses the view sometimes held that a colour filter is advantageous and is so because it reduces the intensity of the beam.

In the second investigation, carried out by van Heel and van Soest(1), in Holland, a large number of commercial head-



Light and Lighting

Variations of range ratio with filter transmission

lights were compared, some of which could be operated with or without yellow filters. The method for determining the range of visibility in the headlight beams was closely similar to that described above. Concurrent measurements of the atmospheric transmission were not made, but it is stated that the fogs studied were thick. Van Heel and van Soest found in every case that the use of a yellow filter either produced no appreciable effect on range or resulted in a decrease. They also found that the effect of under-running the lamp bulbs of the headlights, and thereby reducing the intensity in the beam, was again to decrease range. These results are in good agreement with the conclusion of the N.P.L. investigation.

Monnier in France(2) determined the range of visibility of a test object in the beams of a series of headlights fitted with lamp bulbs of coloured glass or employing reflectors plated with various metals (copper, gold). The atmospheric transmission at the time of the range measurements was determined. Of the eight atmospheric conditions studied only two (atmospheric transmission equal to 73 and 56 per cent. over 100 ft.) correspond to actual fog and these represent comparatively thin fog. We will deal with the results for these atmospheres first. Comparing the range obtained with each of the coloured beams with the range for white, in no case was the range significantly greater for the coloured beam. For the headlight employing a lamp bulb made of a special cadmium yellow glass developed by Monnier and Mouton the range (mean for the two atmospheres) certainly exceeds that for the white light headlight by 2 per cent., but the difference is too small to have any practical significance. Thus Monnier's results confirm the main conclusion of the other two investigations that no advantage is to be gained.

The other six atmospheres studied by Monnier are described by him as clear (*atmosphères limpides*) and correspond to atmospheric transmissions lying between 96 and 99 per cent. per 100 ft. In these atmospheres a slightly greater range (on the average about 6 per cent.) was obtained with the yellow beam than with the white. It should be noted, however, that the ranges obtained were very large, of the order of 900 ft., and we may expect the slight advantage of yellow light to be considerably reduced if not completely eliminated for nearer objects at distances not greater than, let us say, 500 ft., which are the principal concern of the motorist in clear weather.

It has recently been decided in France to make obligatory the use of headlights emitting yellow light. As we have just seen the evidence is against the view that visibility in fog will be improved by this measure. However, it is also claimed that in clear weather there will be better vision of objects on the road and less dazzle from the headlights of other cars. These claims are examined in a Report just issued by the Department of Scientific and Industrial Research.* The Report states that the evidence on the "clear weather" advantages of coloured headlight beams is inconclusive, but that further investigations are unlikely to reveal any substantial benefit.

The following reasons may account for the prevalent opinion regarding the benefits of filters:—(1) By the use of a colour filter the brightness of the fog ahead of the car is reduced, giving the driver the *impression* that the fog is less dense. (2) The sensitivity of the eye to brightnesses to the side of the direction of vision is less for yellow than for white light and this also gives the *impression* of less fog when a yellow or amber filter is used. (3) Only a small reduction of range in fog results from the use of most of the common fog filters. Thus free play is given for any bias in favour of yellow light created by arguments based on Rayleigh's law or by the claims of advertisers. (4) Some individuals have a "psychological" preference for yellow light apart from the question whether it allows them to see farther or with more certainty.

Rayleigh's Law of Light Scattering

Rayleigh was able to show that the scattering of light by small dielectric particles must be greater for light of short than of long wavelength. The theory leading to this conclusion rests on an important assumption, namely, that the linear dimensions of the particles must be small compared with the wavelength of the light used. The wavelength of visible light ranges from 0.4×10^{-4} cm. in the extreme blue end of the spectrum to 0.76×10^{-4} in the extreme red end. Thus if the particles of fog had radii small compared with these values we could apply Rayleigh's theory and we should be justified in expecting some advantage from the use of light of long wavelength. Actually, meteorologists give values for the average radius of fog particles which are greater than the longest wavelength of the visible spectrum. In the work of Monnier measurements of the radius of fog particles are reported which range from about 3 to about 8 multiplied by 10^{-4} cm.

It is clear that with particles of this order of magnitude Rayleigh's law of scattering is inapplicable. It is natural to inquire how the amount of scattering varies with the wavelength when the particles are large. Calculations made by Stratton and Houghton show that the variation is complex. Taking a particle of radius r, scattering decreases with increase of wavelength λ for λ greater than r, increases with increase of wavelength for λ between r and $0.55\ r$, again decreases with increase of wavelength for λ between $0.55\ r$ and $0.42\ r$, and finally increases with increase of wavelength for λ less than $0.42\ r$.

Other Practical Problems

The use of coloured light for headlights in fog has been dealt with at length because it is a question on which recent work enables us to draw a definite conclusion. A somewhat analogous problem is the application of coloured light for searchlight beams. There is an important difference, however. To be of value a searchlight must reveal objects at a great distance from the projector, so that searchlights can be used only on fairly clear nights. Monnier's results show that on clear nights coloured light may give some advantage for ranges of the order of 900 ft. We may expect this advantage to be increased for greater ranges. The results of quantitative tests of the value of coloured light for searchlights are not available.

Finally, a problem of a different kind arises when we consider the distance at which the light source itself can be seen in fog. This problem has a bearing on the use of coloured light for aviation beacons and again only very light fogs are in question. Breckenridge and Nolan† have shown by direct tests that no increase of range is to be obtained by filtering out the blue end of the spectrum of a white light with the aid of a red filter.

(1) *De Ingenieur*, July 12th, 1935.

(2) "*Etude de l'efficacité des projecteurs au travers d'atmosphères non limpides*," Sauvion and Lelièvre (Paris), 1936.

* "The Use of Coloured Light for Motor Car Headlights," H.M. Stationery office, 1937.

† Bureau of Standards, *Journ. Research* 3, 1929, p. 11.

E

Meetings and Discussions

An eminently practical paper based on actual experience of rural electrification was read by Mr. J. S. Pickles, Dumfries County electrical engineer, at the Institution of Electrical Engineers yesterday (Thursday). At a meeting of the Wireless Section on Wednesday the mysteries of the magnetic tape recorder, now so often employed by the B.B.C., were unfolded by Messrs. A. E. Barrett and C. J. F. Tweed. Another address born of personal experience was that on the planning of a modern power station delivered recently by Mr. F. W. Lawton at a meeting of the Birmingham Electric Club

Rural Electrification

SOME of the general considerations which have emerged during recent years from experience of the electrification of country districts are reviewed in a paper by Mr. J. S. Pickles which was read at the INSTITUTION OF ELECTRICAL ENGINEERS in London yesterday (Thursday). A study is made of the available load and the revenue obtainable from the various types of consumers commonly found in rural areas, and is supported by actual figures obtained in practice. A separate examination is made of the development of farm load, with details of the results from a large number of farms.

A large amount of data is presented dealing with cooker maintenance, slot-meter practice, maximum demands, and earthing. Special attention is called to the economies in capital cost obtainable by extensive use of the single-phase system of supply and by the surface-wiring method of distribution.

The author then describes the development and working results in his own large rural area, comprising the whole of the geographical county of Dumfries, over 1,000 square miles. Since the area is a self-contained one and the undertaking is entirely new, the results are not masked in any way by other trading operations and they may be of value as a guide in any comprehensive scheme of rural development.

Finally, the author concludes that "rural electrification," by which term is meant not only supplies to all rural centres of population but penetration to farms and isolated premises, is now commercially feasible. In any rural area, it appears practicable to give supplies to every town and village without financial loss.

The provision of public supplies of electricity throughout rural areas is regarded in all progressive countries as an urgent and important necessity for the general welfare and it is probable that about one-third of the total premises in rural areas now have public supplies.

It appears to the author that a budgetary policy in which deficiencies, or narrow margins of profit, in the early years are balanced against the increasing returns of later years, can be safely adopted since ultimate financial success is reasonably assured. A 10-year basis is suggested and, while it cannot be expected that rural schemes can provide for both interest and depreciation from their inception, it is felt that in general a self-supporting basis will be reached by the end of five years.

Minimum capital cost of construction and rapid expansion of revenue are a *sine qua non* for success, and underground cables should never be used except in circumstances prohibiting the use of overhead lines. The utmost use should be made of surface-wiring distribution in built-up areas. Small villages and isolated premises, including farms, should be supplied single-phase from high-voltage tappings.

Hiring and assisted-wiring schemes are essential and special prominence should be given to the two-part method of charge. A charge of 1d. per kWh, even for the first block of units, is definitely restrictive and hinders development, whereas ¾d. will not restrict the development of the cooking load, is a reasonable charge for occasional heating, and will permit partial development of water heating. Full development of space and water heating can only be obtained at ½d. per kWh or less.

Free availability of slot meters appears to be vital not only for flat rates but more particularly for the two-part tariffs, since the majority of rural workers, even though of thrifty habits, are unable to face a quarterly bill. A service charge, however trivial, is a perpetual source of annoyance and causes more trouble, and loss in the form of delayed revenue, than the amounts contributed are worth. If unavoidable, the method of guaranteed revenue is preferable to that of capital contributions, since the consumer will usually arrange to make corresponding use of the supply. It is suggested, nevertheless, that it is quite possible to develop a rural area intensively without requiring any capital contribution or guaranteed revenue.

Farms, which of all classes of rural consumers are the slowest in development, will usually reach an economic revenue in five years. Subject to the adoption of a suitable policy the author concludes that, given a *normal* distribution of population, even in areas where the *effective* population is as low as 100 persons per square mile, it is possible to establish a network providing general supplies in every town and village without fear of financial loss, though care will have to be exercised to keep capital costs to the absolute minimum and to ensure that all consumers make adequate use of the supply provided.

Such development would normally cover from 70 to 80 per cent. of the total consumers within the area, and the remaining consumers can only be reached by extensions done on a basis which ensures, by agreement, an adequate return. The average capital cost of connection of each consumer, up to 75 per cent. saturation, need not greatly exceed the cost of attaining a similar degree of development in a city or built-up urban area. The average revenue obtainable from domestic consumers in rural areas is higher than the corresponding revenue obtainable in city or urban areas, and, in consequence, development in rural areas may be expected ultimately to be as remunerative as that in urban areas.

Planning a Power Station

THE creation and development of a modern power station was the subject of an address delivered by Mr. F. W. Lawton (chief assistant electrical engineer of the Birmingham Electric Supply Department) to a meeting of the BIRMINGHAM ELECTRIC CLUB on November 22nd.

Mr. Lawton dealt first with the choice of site. For a 300,000 kW station, he said, the coal consumed in a year would be about a million tons. A variation of only two shillings in coal transport charges would, therefore, mean £100,000 per annum. The selection of generation voltage must depend on local conditions, and choice of turbo-alternator sizes ranged between 1,000 kW and 160,000 kW, depending mainly on the average daily load curve. Large machines might take from one to six hours to start up from cold and the heat losses incurred by frequently starting up and shutting down large turbines might easily outweigh their running economy when compared with smaller sizes. In a modern power station, Mr. Lawton said, the cost of coal per kWh at the station bus-bars represented about 80 per cent. of the total works cost. A careful heat cycle study was, therefore, most important, for it controlled the design of turbine, condenser and boiler unit. The regenerative heat cycle, paid best generally below 60 per cent. load factor. Above 60 per cent. the re-heat cycle began to show financial advantage.

The fight for supremacy between oil-filled and oil-less switchgear was still being waged, and further research would be necessary before the issue was settled. Safety was so important that only the best designed and most perfect circuit-breakers should be considered. Price was a secondary matter.

The keynote of a good plant layout was simplicity and uniformity, and in designing buildings the engineer must possess a working knowledge of building construction. The architectural features of some power stations in this country and abroad offended the canons of good art by adopting false and costly ornamentation, borrowed from contemporary architecture and alien to the purpose of the project.

Magnetic Tape Recording

THE object of the paper by Messrs. A. E. Barrett and C. J. F. Tweed which was read before the Wireless Section of the INSTITUTION OF ELECTRICAL ENGINEERS in London on December 1st is to outline the theory and describe some of the methods and apparatus that have been developed by the British Broadcasting Corporation and Marconi's Wireless Telegraph Co., Ltd., for the magnetic recording of sound on steel tape. The scope of the paper is limited almost wholly to work that has been done in this country. A standard of performance is now obtainable which enables this system of recording to be extensively used in connection with broadcasting.

By virtue of its coercivity neighbouring elements in a length of steel tape can be magnetised, to a great extent, independently, so that the passage of such tape at constant velocity through an electromagnetic recording head will produce variations in the distribution of remanent flux along its length.

Reproduction can be effected by passing the magnetised tape at an identical velocity through a reproducing head which is sensitive to changes of the flux in the tape. The spatial variations of flux will then be transformed into alternations of e.m.f. with respect to time. It is necessary that any previous variations in the flux distribution in the tape should be

removed before recording by passing the tape through a "wiping head," the action of which is to magnetise the tape to saturation.

It is necessary to introduce a medium of high permeability into the system in order to concentrate the field. Each head consists of two similar blocks of insulating material held together by a hinge at the back. When closed a slot is formed for the tape to pass through. In each half a strip of magnetic alloy known as a "pole piece" makes mechanical contact with the tape when the head is closed. The pole-pieces are at right angles to the plane of the tape and are surrounded by coils through which they are free to slide, the pressure of the pole-pieces on the tape being adjusted by spring-loaded plungers. One half of the head can be moved in relation to the other, in the direction of the movement of the tape, so that a variable longitudinal gap is formed between the two pole-pieces.

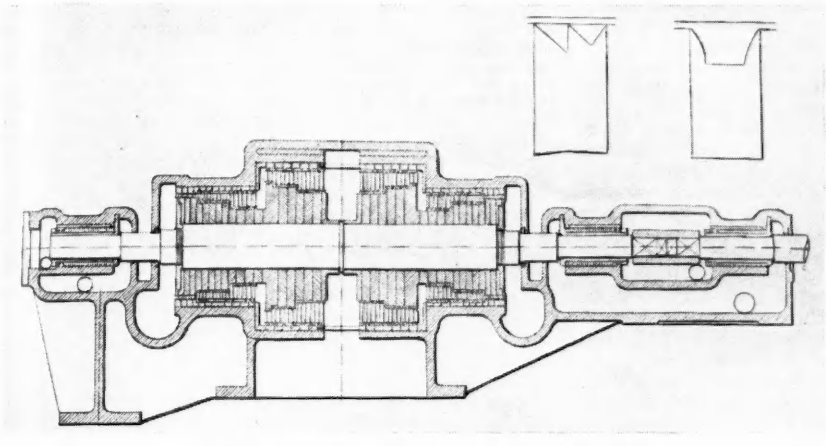
The tape may be magnetised longitudinally or transversely, through its width or through its thickness, or in any combination of these directions. Transverse magnetisation through its width gives inferior results.

The results obtainable as a whole are to a great extent dependent upon the quality and uniformity of the tape, which is made of tungsten magnet steel melted in an acid open-hearth furnace from pig-iron produced in an electric charcoal blast-furnace from the purest ores, and scrap iron of known analysis. It is first of all hot-rolled under temperature control and then cold-rolled, cut, and polished, undergoing during the process various heat treatments of such a nature that the possibility of magnetic ageing is reduced to a minimum. This allows a tape to be stored for a number of years after recording without noticeable deterioration of the quality of the recording. The final dimensions of the tape are 0.08 mm. thick and 3 mm. wide, and it is rolled into lengths of about 1,000 metres.

Each spool of tape used for recording has to run for about half an hour at a speed of 90 metres a minute, so that some 2,700 metres is required. This means that even in a new tape there will be at least two joints, which are made by means of silver solder. In the past, if breaks occurred in the tape during normal running, soft-soldered joints were made. A system of welding the tape is now being tried, however, which gives most encouraging results.

There are three separate mechanical drives, one for unwinding the tape from the trailing reel, another for maintaining the velocity of the tape constant through the heads, and the third for winding the tape on to the leading reel. The constant-speed system is virtually isolated from the unwinding and winding systems by the provision of reservoirs, one preceding it and one following it, and the speed of the winding and unwinding motors is automatically regulated so that both reservoirs always contain a loop of tape. These two motors are of the induction type, with their rotor windings brought out to three slip-rings and their brushes connected to external resistances arranged as a three-phase star-connected system.

The constant-speed drive system is not required during the rewind, and an automatic release clutch is provided for disconnecting it.



First low-pressure turbine (1889) with shrouded beading

Parsons's Scientific Activities

THE subject of the second Parsons Memorial Lecture, which was given by Dr. Gerald Stoney at the INSTITUTION OF ELECTRICAL ENGINEERS on November 25th, was some of the less well-known activities of the late Hon. Sir Chas. Parsons, with whom the lecturer was in the closest touch during his most prolific inventive period from 25 to 30 years ago.

Production of power from the kinetic energy of a jet of gas for the propulsion of vessels was one of his earliest interests (about 1880), leading up to the development of the steam turbine idea of which owed its conception to an analogy between the flow of steam under small difference of pressure and the flow of an incompressible fluid like water.

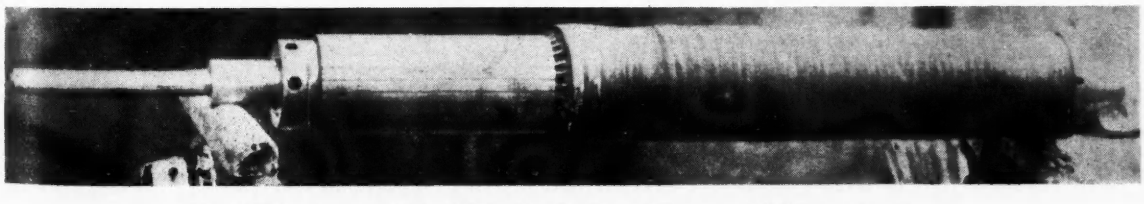
Although possessed of a high mathematical ability Parsons very rarely made use of formal mathematical reasoning, his solution of problems being the outcome of scientific habits of thought. Not until turbines had been built for nearly thirty years was his staff able to evolve a sound theory of the steam turbine; previously the proportions of the blading were worked out in each case by Parsons himself by simple formulæ, the derivation of which was obscure to others but which were entirely effective.

Parsons did not use a slide rule, as he could work out results in his head as quickly without, and seemed not to appreciate the value of the Mollier diagram or of the theory of entropy. His mind was thoroughly practical, and he possessed great manual dexterity, often building models as means of studying problems in hand. When the first steam turbine was constructed in 1884 — a parallel-flow 10-h.p. 18,000-r.p.m. machine — generators usually ran at 1,200 r.p.m. Parsons, partly by intuition and partly by some extraordinary application of the "rule of three," designed a 4.5-kW 65-V dynamo for direct coupling.

The first turbines for public supply were four 75-kW (the largest then built) 4,800-r.p.m. single-phase machines generating at 1,000 V on 80 cycles, installed in Forth Banks power station at Newcastle-on-Tyne in 1888. In 1891 a 100-kW unit in the same station was the first condensing turbine; its steam consumption was 27 lb. per kWh, with steam conditions of 100 lb. per sq. in. and 45 deg. F., and a vacuum of 28.75 in., twelve years before his use of the steam jet for removing air.

Improvements in the forging and casting of steel required for coping with increases in size and speed were also subjects of successful activities, which also included the construction of turbo pumps and high-speed exhausters and blowers. One of the rare cases in which Parsons did not succeed was in the design of parallel-flow blowers in 1901, but the principle is now being worked out on the Continent. Problems of cavitation, and the erosion of marine propellers owe very much to his investigations in more recent years. In his younger days Parsons interested himself in the manufacture of arc and incandescent lamps, with some success, but after 1889 took little further interest in the subject.

Another leading interest of his was optical work, and in 1886 he devised a process for the hot bending of glass to secure a parabolic form of reflector which had not before been done inexpensively, but which, like so many of his methods, remains in use to-day with little alteration. This was a precursor of his post-war acquisition of an optical glass-works near Derby, which did much to create the reputation of English ware, and to the formation of Sir Howard Grubb, Parsons & Co., which has the 74-in. telescope at Toronto and



The first dynamo armature (4-5 kW) for direct coupling to an 18,000-r.p.m. turbine

a similar one under construction for Pretoria among its achievements.

The question of the origin of diamonds engaged his attention, but his experiments, conducted at pressures up to 75 tons per sq. in. and with currents up to 80,000 A, were unfruitful. Observations made during these experiments enabled him to use the same 2,500-ton press to measure the compressibility of liquids at about 40 tons per sq. in.

A steam-engine (¼ h.p., 1,200 r.p.m.) with its cylinder inside a boiler to prevent condensation, was used in 1893 to propel a monoplane about 80 yards at a height of 20 ft. in the air and also to drive a small car, Other subjects in which Parsons took an active interest included the "Auxeto-phone" for improving the sound reproduction of gramophones, the silencing of guns, and the possibility of securing valuable geographical and mineralogical information from a ten-mile shaft into the earth. In his young days Parsons was a competent violinist and sportsman.

Heating and Hot Water

TWO papers were submitted at a joint meeting in London on December 1st of the INSTITUTE OF FUEL and the INSTITUTION OF HEATING & VENTILATING ENGINEERS. In one of them Mr. H. L. Pirie (chief engineer, Coal Utilisation Council) dealt with British coal and its derivatives for heating buildings and furnishing hot water. He remarked that for intermittent space heating gas and electric fires had definite advantages, particularly when domestic labour was at a premium, and they were smokeless.

He deprecated attempts to obtain comparative costs of *direct* heating by means of solid fuel, gas and electricity because in his view each had its field of usefulness and one was not invariably a satisfactory substitute for the others. Mr. Pirie submitted that the standard of heat comfort in this country should be raised and that central heating should be regarded as supplementary to, and not a substitute for, other forms of heating. He stated that increasing use was being made of gas and electricity for central heating purposes, and that when the price was right they were ideal for the purpose.

In claiming advantages for oil fuel in the second paper Mr. I. Lubbock did not rule out the fact that gas and, as he said, "to a certain extent electricity," have in many cases similar advantages. He mentioned unit factory heaters started by time switches in conjunction with a fully automatic oil-fired steam boiler equipped with thermo-electric feed water regulators. Oil and water pumps and blower fans were motor driven, the oil might be ignited electrically and other electric or photo-electric controls might include magnetically or motor-actuated valves, circuit diagrams being fully explained in the original paper.

The Ljungström Turbine.—In a lecture delivered to the ELECTRICAL POWER ENGINEERS' ASSOCIATION (London Technical Group) on November 30th Mr. P. S. Wakefield stated that the Ljungström turbine was first designed as the single-rotation radial-flow equivalent of a very short axial-flow reaction turbine with narrow blades, but double rotation was actually adopted and enabled higher efficiencies to be obtained with far fewer stages. The first 1,000-kW double-rotation turbo-generator set was tested in 1910. The blades are arranged in concentric rings secured alternately to the faces of two parallel discs overhung from the bearings of two half-capacity generator rotors. High-pressure steam is taken to cylindrical forged steam chests situated one on each side of the blade system, passing to the centre of the turbine and thence outwards through the blade rings. Packing devices limit leakage of steam between the fixed and moving parts. There is no high-pressure cylinder, the complete blade system being contained in the unlagged low-pressure casing. The condenser forms the foundation for the turbine. Outputs up to 4,200 kW are obtained from turbines containing only radial-flow blading, but larger units are fitted with double-axial-flow exhaust stages in the same casing. The blades of the smaller sizes are welded into the rings, but those of the larger are machined with integral roots from alloy steels. Turbines up to 35,000 kW have been built to run at 3,000 r.p.m., and 1,500-r.p.m. machines are in service up to 54,000 kW. Turbines up to 100,000 kW, still in one casing, are projected. The light, flexible construction of the moving parts enables the turbines to be started in a few minutes without preliminary warming or slow turning. High temperatures are confined to the lightly stressed high-pressure rings of small diameter. Feed heating by bled steam can be incorporated. Double-rotation back-pressure turbines have been built in large numbers up to 21,000 kW.

Supersonic Vibrations.—Some industrial applications of supersonic vibrations were described to members of the INSTITUTION OF CHEMICAL ENGINEERS in London on November 30th by Prof. H. Freundlich. He explained that acoustic waves having a frequency of more than 15,000 cycles per sec., the upper limit of audible sound waves, could be produced by the mechanical oscillations of a piezo-electric crystal under the influence of a rapidly alternating electric field, or by the periodic contraction and extension of a ferro-magnetic metal (nickel or iron) in an oscillating magnetic field. Supersonics might also be produced by purely mechanical means, for instance, by a thin jet of gas moving with a speed exceeding that of sound waves and hitting a very small cavity placed in a suitable position to the jet. The following properties, namely, shortness of the wavelength, the lively movement of small solid or liquid particles in gases caused by them and the great energy they might be made to possess caused many special phenomena capable of technical applications. Owing to the first two properties supersonics had been applied for under-water signalling, detecting flaws in metal pieces, special devices in television, degassing of liquids, and for precipitating fogs and smokes. Owing mainly to the third property they had been used for emulsifying liquids, homogenising photographic emulsions, dispersing metals, producing fogs, destroying gels and small living organisms, sterilisation of milk, and for such medical purposes as local heating.

Electric Welding.—An an informal meeting of the I.E.E. held on November 22nd, with Mr. P. P. Wheelwright in the chair, Mr. J. A. Dorrat opened a discussion on "Recent Developments in Electric Welding," showing lantern slides of charts and oscillographs of voltage and ampere fluctuations and later views of structures that had been reinforced by the welding on of metal strips. He anticipated a more general advance due to the evolution of equipments with arc-controlling relays and automatic feeding of the electrodes and showed the importance of quick response by the welding generator to the rapid variations in voltage. Peaks in the arc current were, he demonstrated, due to the blob of metal from the electrode causing an actual short-circuit in the process of transference, and this demanded a machine which would react quickly to the arc conditions.

Domestic Apparatus Design

SOME time ago the Electrical Association for Women organised an inquiry into the present design and performance of domestic electrical appliances and obtained the views of its members on how existing designs might be improved. A report based on the replies received was sent to the various interested electrical organisations, including the Incorporated Municipal Electrical Association, and meetings were held between representatives of the E.A.W., the I.M.E.A., and the B.E.A.M.A.

The recommendations made included a suggestion that flush-mounting cooker control units should be made available for use in suitable cases (these have since been placed on the market). It was thought that the type of cooker sometimes referred to as a table cooker, with oven and hotplates on the same level, should become the standard form or that oven and hotplates should be built as separate units for horizontal or vertical mounting as desired. The manufacturers agree that it would be possible to build the table cooker at very little additional cost provided the demand was large enough, but the serious obstacle to its more general adoption was lack of space in the average kitchen. It was agreed that all the organisations concerned should endeavour to persuade architects and builders to provide appropriate accommodation for equipment.

Although the grill-boiling plate gave very satisfactory service, it was agreed that the ultimate development of the electric cooker should provide a grill as a separate unit.

The handles of portable and semi-portable electric fires should, it was considered, be heat-insulated and the position at rest should be away from the fire. Fires with one bar switched on from the plug should have the upper bar thus controlled to reduce the possibility of scorched carpets. A control switch should be fitted to every washing machine.

The review covered practically every type of domestic and domestic laundry equipment, including flexibles and accessories, and many criticisms and recommendations were passed for consideration to the manufacturers. A number of these recommendations have, in the meantime, been adopted. In some cases the suggestions made would affect the cost, but some of these refinements could obviously be introduced into the more expensive designs of apparatus now appearing on the market.

Both the I.M.E.A. and the manufacturers agreed that the inquiry and the report had been of great value and they hoped that the E.A.W. would continue to develop its educational work and, together with the E.D.A., use all its influence with architects and builders, as so many improvements resulted from their work. Undoubtedly the E.A.W.'s kitchen planning campaign will direct increasing attention to this question of apparatus design.

Standardising Voltage

Changing over to 230 V in Sutton

IN a report that contains a large amount of practical data and commentary Mr. F. W. Purse, chief engineer, London and Home Counties Joint Electricity Authority, gives particulars of the work carried out in converting the 200-V single-phase supplies given in the Sutton district to the standard 230 V. Sanction was obtained from the Electricity Commissioners in August, 1934, and work started on October 15th, at which date about 35,600 consumers were connected, excluding 2,000 on new estates to whom 230-V supplies were given on connection. On the completion of the change-over on February 23rd, 1937, eight months earlier than was originally allowed for, the number of consumers dealt with was 38,600. The estimate was £133,000 and the actual cost about £121,000.

Progress was facilitated by the creation of a separate department, to which all correspondence was sent direct. The staff of fifty (including ten permanent members) was under an engineer with one assistant engineer from the mains department and another from the consumers' department. Under these were six inspectors making inventories, two jointers and four mates, fourteen wiremen, six improvers, two van drivers, and thirteen clerks, typists and stores hands.

Auto-transformers were installed on new consumers' premises supplied from distributors that were due for conversion up to four months ahead or where an existing consumer had given notice of his intention to install a cooker or apparatus that would be costly to convert. Sometimes the auto-transformer was installed only in the circuit to which such apparatus was connected.

Besides describing the procedure details are given of interesting incidental information

Average Disconnection Two Minutes

The mains assistant was responsible for the alterations required in the network and sub-stations on weekly programmes made out a month in advance. One of his jointers was employed on the sub-stations and the other on mains. Change-overs were usually made between 1 and 2 p.m., but varied with the requirements of the consumers, especially hairdressers, dentists and hospitals. The maximum time that supply was disconnected from a consumer's installation was five minutes, but the average time taken to effect the increase in voltage was two minutes.

Owing to the difficulty of obtaining entry for a number of visits, the procedure ultimately adopted was for the lamps for individual consumers, together with elements for site conversion and tie-on labels for apparatus to be collected for conversion, were loaded on a van upon which the wiremen also travelled. On completion of the work the wireman concerned obtained the signature of the consumer to a form signifying the exchanges that had been made and noted on the label any defects in apparatus removed. On the following day the old lamps were broken up and the collected apparatus forwarded to manufacturers or contractors for conversion. The redelivery and connecting of converted apparatus was an expensive item and entry was not always obtainable.

In the majority of instances heating apparatus was sent to one contractor, thus obviating the need to stock numerous types of element. A record was kept of the consumption at 200 and at 230 V. Often it proved cheaper to install a new element on site, especially in the case of irons and reflector fires.

About 80 per cent. of the radio receivers were mains operated and all but 10 per cent. of the latter had multiple tappings on the mains transformer; normally adjustments were entrusted to one firm. Vacuum cleaners (some of which were on hire-purchase or maintenance agreements) were generally converted by the makers, but the lesser-known of the seventy makes were dealt with by contractors with experience.

Appliances in commonest use were lent to consumers on request, but special arrangements were necessary for the conversion of unusual apparatus. That of the 83 hairdressers in the district cost £10 10s. each to convert by the makers, the highest being £73. Expenditure on converting the apparatus of twenty-two dentists, usually consisting of an X-ray machine, lathe, surgery unit and dental engine, averaged £3 each. In addition to these there was a large number of home-made and other often unsafe electrical appliances of unusual kinds that entailed difficult negotiations, but the items that gave most concern were those regarding which no indication was obtainable as to voltage range and loading. Cheap boiling rings, soldering irons and hair-curlers of foreign make, purchased by large stores as job lots, were the most common offenders.

Apparatus of good quality was usually well marked, but the consumption given on the name plate was not always correct, particularly for irons, toasters, curling irons and even kettles. Elements for coffee percolators sometimes varied by 25 per cent. from the loading ordered, while of fifty elements ordered for 560-W bowl-fires half were between 700 and 900 W.

It was found impracticable to maintain a constant weekly rate of change-over of connections, as the work involved depended upon the size of installations rather than on the number of consumers. A representative week's work with the £400 to £700 class of residence was 481 consumers with the following average number of appliances: Lamps, 7.8, fires 0.4, irons 0.47, vacuum cleaners 0.19, radio 0.75, cookers 0.08. For houses costing from £700 to £1,000, the number of consumers was 323 with the corresponding figures 15.3, 0.58, 0.58, 0.36, 0.77, 0.11. In the £1,000 to £2,000 class the equivalent for 265 consumers were 30.4, 1.37, 0.91, 0.69, 1.0 and 0.07. The report discusses possible reasons for the varying popularity of different types of apparatus in the three groups.

In order to obviate complaints as far as possible the 513,000 lamps of 550 types removed, even if of cheap or foreign make, were replaced by those of Association manufacture. Failures reported (including mechanical damage) amounting to 2 per cent. were rectified free of charge.

The total cost of the change-over has worked out at £3 13s. per consumer. The expenditure is made up as follows:—Lamps, 520,260, £29,900; motors, £4,500; transformers, 15,500 kW, £10,590; radio, 26,490 tap-changed and 3,046 rewound, £7,400; cookers, 2,753, £3,960; fires, 21,827, £4,820; irons, 20,084, £1,650; vacuum cleaners, 11,748, £9,920; miscellaneous, £4,190; supervision, labour and overhead, £43,940.

The expense of converting the most popular type of vacuum cleaner varied between 25s. and 12s. 6d., the average for all types being 16s. 10d. For fires the cost of changing elements ranged from 15s. to 1s. The average per consumer of the most popular pieces of domestic apparatus was: Lamps 13.9, radio 0.8, irons 0.54, fires 0.59, kettles 0.07, toasters 0.04, vacuum cleaners 0.32, cookers 0.07, and wash boilers 0.01. For electric fires the most usual loadings were from 550 to 650 W.

A commentary on the value of detailed statistics of items installed on consumers' premises is provided by a comparison between the load found to be connected on taking inventories and the "connected load" according to the previously existing records. The actual figure was 108,706 kW as against 53,076 kW declared, the difference being due to consumers not troubling to notify the supply authority when installing new appliances, as they are required to do under the terms stated on the application form.

Phase Reversal

AFTER the blowing of a use in one phase of a three-phase line tapping the system of a large Canadian undertaking, some of the motors connected stopped and restarted in the reverse direction. Laboratory experiments referred to in *Electrical News and Engineering* showed that if the length of line between the fuse and the step-down transformer is sufficient to introduce appreciable capacitance between it and the other two phases or earth, only single-phase voltage appears in the secondary circuit when there are relatively low voltages on the primary. With higher primary voltages a region is reached where positive sequence three-phase voltage usually appears in the secondary and with still higher voltages a region of reversed sequence accompanied by harmonics in voltage and current waves. Phase reversal occurs only (but not always) when one phase is opened at a point remote from the transformer. For given test conditions a system voltage could be determined above which phase reversal almost invariably occurred and another voltage below which single-phasing followed the operation of the test switch. Certain lengths of line in combination with certain sizes and types of winding of transformers proved more liable to cause phase reversal. With star-connected transformers phase reversal is accompanied by the appearance of considerable voltages between neutral and earth and between line conductors and earth. The most practicable way to prevent phase reversal is to use circuit-breakers instead of fuses for the protection of circuits remote from the transformer and in the case of star-connected transformers to earth the neutral.

Correspondence

Contributions from readers are welcomed. The writer should give his name and address, not necessarily for publication

The Street Lighting Report

The review of the final report of the Departmental Committee on Street Lighting by Dr. W. T. Walsh appearing in the current issue of the ELECTRICAL REVIEW is of great interest to all concerned with street lighting problems.

Dr. Walsh states that the 250- and 400-W mercury lamps have a lumen output, provided that 60 per cent. of the light from the source be emitted from the lantern, sufficiently high to be used to meet the recommendations of the report as regards traffic route lighting. Is it to be assumed from this statement that as much as 40 per cent. of the light is absorbed by the fitting when this type of electric-discharge lamp is used?

With sodium lamps, however, having very low surface brightness and needing no protection against the elements, it is unnecessary to obscure the light source. It would appear that the 400-W mercury lamp, having an initial output of 18,000 lumens, gives only 10,800 effective lumens when used for street-lighting. This compares unfavourably with the 9,600 lumens which is the output of the 150-W sodium lamp.

By the same method of computation, the effective light given by a 250-W mercury lamp amounts to 5,400 lumens as compared with 6,100 lumens, which is the initial output of the 100-kW sodium lamp. HOWARD V. CRISP.

Nottingham, *November 27th.*

Indian Water Power

Your review of Prof. Shiv Narayan's book "Indian Water Power Plants" is the first critical review of this book that I have come across. A reply is called for to some of the criticisms in fairness to the author.

(1) The reviewer states: "The cost of the Uhl River Scheme is no less than 7 crores, according to Prof. Narayan." The words actually used in the book are: "The cost of the scheme is *stated* to be *about* 7 crores." The words italicised show that Prof. Narayan was cautious in framing his sentence. The figure of cost is to be found on page 157 of the book in an extract from the *Journal* of the Association of Engineers, which gives Rs.645 lakhs (6.45 crores) as the cost estimated for the year 1930, some years before the scheme was completed.

Prof. Shiv Narayan expressed his belief that the scheme "is sure to prove a success from a financial point of view (after the load has risen and the revenues stolen a march over the expenses) as it is already from other standpoints, particularly the industrial advancement of the people of the Punjab."

(2) The reviewer says: "Neither the index nor the text mentions Col. B. C. Battye, the originator of the Uhl Scheme." That there was, however, no intention to leave his name out is clear from the fact that it is mentioned in Prof. Shiv Narayan's earlier book, "Hydro-Electric Installations of India." Names already mentioned in the earlier book have not all been mentioned again because the later book is a companion volume to the former, and the author says at the outset of the second chapter that he wishes to avoid unnecessary repetition of facts and figures. This accounts for the frequent mention of the earlier book, which your reviewer decries, but it served to reduce its size and price.

(3) The reviewer goes on to say: "The same remark applies to many other European names well known in connection with Indian projects." Referring to the index of H.E.I.I., one finds that 39 European names were mentioned as against only 17 Indian names, and in the index of I.W.P.P. 24 Europeans are mentioned and 19 Indians. Your reviewer is invited to communicate the names of prominent Europeans worthy of mention in connection with the schemes referred to who have not been mentioned in one or other of the books.

(4) The reviewer blames the author for the "blemish" that "the official report of the Hydro-electric Survey of India is barely mentioned and not indexed at all." The Preliminary Report came out 18 years ago and is frequently referred to in the earlier book which was published in 1922. The Triennial Report of the Survey (issued at its termination) appeared in 1922, too late for mention in the first book and too early for *frequent* mention in the later one. However, it is referred to on pages 71, 133 and 136.

(5) The reviewer accuses the author of "wrongly placing the discovery of the Uhl or Ool installation in 1922, which originated in the report of the Survey." The Preliminary and Second Reports of the Survey do not mention it; the Triennial Report, which does so, came out in 1922, the same year as mentioned by Prof. Shiv Narayan as the year of the Uhl scheme in its present form. By the way, the Triennial Report attributes the finding of the scheme-site to Mr. Gilbert, Executive Engineer; whereas your reviewer calls Col. B. C. Battye the originator of the Uhl scheme. "Hydro-electric Installations of India" (page 172) refers to Col. Battye as the officer-in-charge of the Sutlej River project, which was to have its station at Ool, but I believe this project was abandoned when Col. Battye "constructed" (to use your reviewer's word) the present Uhl River or Mandi scheme.

BRIJ NARAYAN.
Publisher, "Indian Water Power Plants."

Poona, India, *November 8th.*

The Resistivity of Water

I was interested in the editorial note on this subject in your issue of November 12th. The water with the lowest conductivity that I have heard of was the condensate at a large London power station where continuous tests showed a conductivity of one unit at 20 deg. C. I have records also of a number of other power stations where the test shows a conductivity of less than 5, while the following table shows the result of tests for conductivity on other water:—

Source of Water.	Conductivity at 20 deg. C. (as actually measured).
Distilled water:	
Average of samples supplied by various chemists	6
Condensate and boiler feed	Between 1 and 5
Cooling water at power stations:	
River Thames at London...	Readings from 550 to 1,200
Tidal estuary	" " 1,000 to 25,000
A water tower	3,825
Sea water—average	50,000
Public water supplies:	
Loch Katrine	34
London—average	420
Southampton	185
Birmingham, from Rhayader	80

The tests mentioned above were made under commercial conditions with the "Dionic" water tester which was developed some twenty years ago for the measurement of the resistance of water and solutions, with a view to ascertaining the amount of inorganic impurity dissolved. The working principle is based upon the fact that the conductivity of water containing any electrolytic substance in solution is due almost entirely to the dissolved substance. Provided the solution is very dilute, the conductivity is proportional to the percentage amount of the substance dissolved. The result is not affected by electrolysis and the polarity, material and disposition of the electrodes is such that negligible contamination takes place during the test. W. A. VIGNOLES,

Managing Director,
Eversheds & Vignoles, Ltd.

Chiswick, W.4, *November 24th.*

Earth Leakage Trips

I am prepared to grant Mr. Taylor his tactical point if he will concede the following: assuming that a leakage trip operating against 800 ohms earth-electrode resistance fails to function with the incidence of, say, 60 V, no danger may arise thereby, owing to the general non-conductivity of the ground.

For a general clarification of the question, the German requirement is that with 800 ohms resistance in the earth circuit the trip must operate with some potential below 65 V. Taking 50 ohms as a fault resistance, and 750 ohms as electrode resistance, it is clear that by no other means than some form of leakage trip can the circuit be isolated, and if this device permits a voltage rise to 65 V the position must be accepted if protection is required, there being no alternative.

At the same time, if the best earth connection that can be made for the installation is in the region of 750 ohms, then this potential can represent no danger to man or beast, as they are in series with at least comparable resistance, and probably very much higher. T. C. GILBERT.

Folkestone, *November 27th.*

Electricity and Sewage Disposal

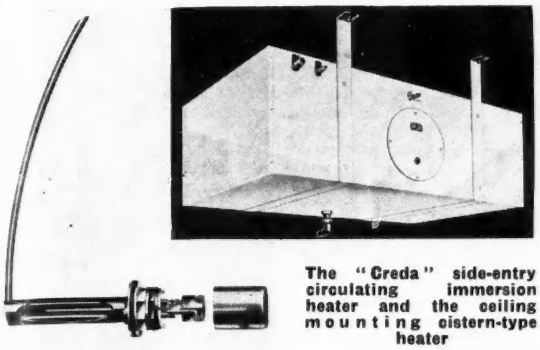
In the course of his presidential address to the Institute of Sewage Purification recently Mr. W. H. Makepeace, Stoke-on-Trent, said that the introduction of cheaper electricity, the comparative ease with which it was distributed, and its present-day reliability for power purposes compared with its uncertainty in that respect during past years, made the consideration of further regional schemes possible, and would so avoid the necessity for small independent works which were now isolated owing to local physical conditions.

New Apparatus and Devices

for Domestic, Cooking and Heating, Lighting, Power and Scientific Purposes

Electric Water Heaters

The new type "Creda" immersion heater for fitting into existing hot water tanks has the heating elements enclosed in



The "Creda" side-entry circulating immersion heater and the ceiling mounting cistern-type heater

tubes which are brazed to the threaded brass collar. Each element is centrally anchored in its tube in special insulating material, and, due to distinctive features of construction, a much higher loading can be given than with the removable element type. It is claimed that efficiency is increased and maintenance reduced. The heater can be supplied without thermostat or with thermostat incorporated. A separate thermostat can be fixed in the tank by means of a small "Easy-Fix" flange. Loadings of either 2 or 3 kW are obtainable.

Two circulating models are offered with the new type immersion heater as their basis. The top entry circulator comprises a new type heater surrounded by a tinned copper circulating tube which carries all the heated water to the top of the tank very quickly. This makes it possible to obtain small quantities of hot water immediately after the heater has been switched on. Thermostatic control is available if desired. The side-entry circulator is for use where there is insufficient top space for a top-entry model.

A new unlagged type non-pressure heater has been designed to cover those situations where occasional supplies of hot water are required at any one point, *e.g.*, at a sink, wash-basin or bath. The loading is high and hand switching is employed. The only pipe connection required is to the cold water main. The heater is constructed with a single case of stout gauge copper, heavily tinned on the inside, and is fitted with a robust bottom of heavy gauge brass carrying all necessary components.

The elements are surrounded by a tinned copper case arranged in such a manner as to provide quick circulation. An internal broken feed device on the inlet pipe prevents the heater from draining dry should the water mains fail.

Strong fixing straps are provided on the heater for mounting to the wall. Specially designed brackets ensure that the weight of the heater is taken along the whole surface of the container, instead of at three or four points. This unlagged model is made in 10 and 12 gal. sizes.

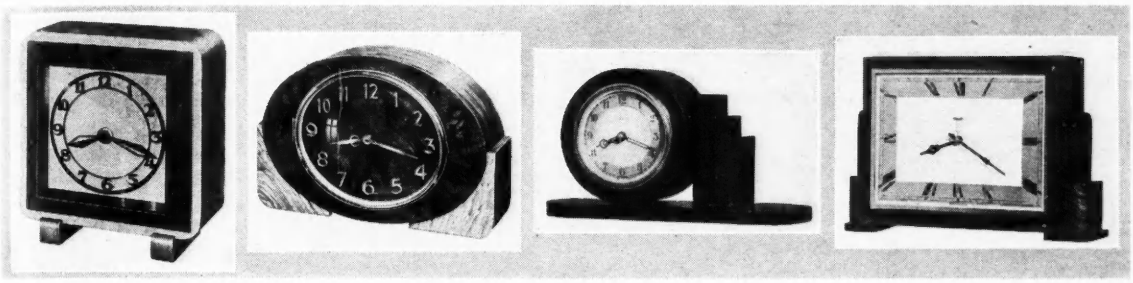
There is also a ceiling model cistern type heater for use in modern flats or other situations where there is no space either on the walls or floor to accommodate a vertical mounting heater of the necessary capacity. It can be mounted on a floor above the level of the highest of the hot water taps to be served. Having a ball-valve cold water supply cistern as part of its construction, it can be connected direct to the water mains, and adequate clearance is allowed over the cistern to make the ball-valve easily accessible. Thermostatic control is employed and 12- 15- 20- and 30-gal. sizes of the cistern are available.

The manufacturers are the SIMPLEX ELECTRIC CO., LTD., Credenda Works, Oldbury.

High-voltage Switchgear

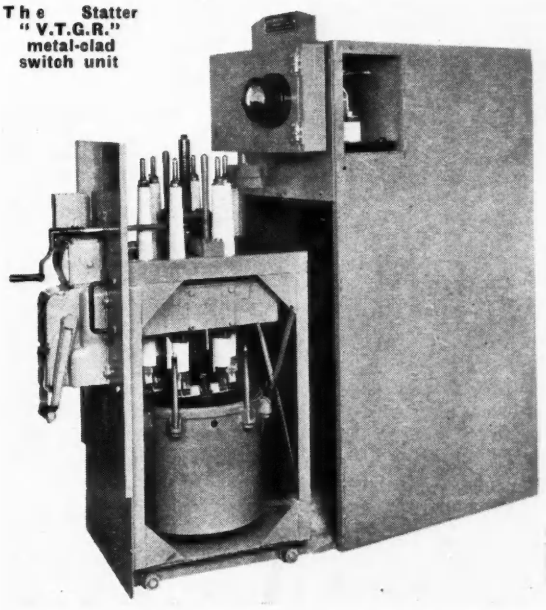
A new type of metal-clad switch unit with steel plate and angle-iron frame, in sizes up to 800 A and 6.6 kV and with rupturing capacities up to 250,000 kVA has been developed by J. G. STATTER & CO., LTD., 82, Victoria Street, London, S.W.1. Type "V.T.G.R." is a self-contained combination of draw-out truck and vertical drop-down isolation, each switch having its own withdrawable railed truck on which is mounted the round tank oil circuit-breaker together with the raising and lowering gear. No more space is occupied when the breaker is isolated than when it is in commission and the panel can be placed against a wall, since cabling is from the front. Separate compartments are provided for bus-bars, current transformers, free-handled circuit-breakers and cable box (receiving cable from below). Automatic shutters prevent access to live metal when the truck is withdrawn.

The isolating plugs and sockets are arranged circumferentially round the central lifting screw, which is operated from the front through worm-reduction gear. The plugs form an extension of the breaker contact stems and engage with sockets on the fixed housing which are embedded in porcelain insulators. Interlocks prevent the plugging in of the breaker except in the "off" position, its isolation in the "on" position, removal of the tank with the breaker plugged in or the plugging in of the breaker with the tank off. Current transformers are usually of the trombone pattern, the size depending on rupturing capacity, ratio, output and class of accuracy. A potential transformer of either fixed or horizontal draw-out type with interlocked safety covers is normally mounted at the top of the unit. Instruments are mounted on a hinged panel forming the front of the wiring box containing the terminal boards.



Four new clocks: The first two are T.M.C.-Harwell Sales models and the others by Ferranti, Ltd.

The Statter "V.T.G.R." metal-clad switch unit



A Gate-end Switch Rating

In our issue of November 19th (p. 711) we described an automatic gate-end switch produced by British Jeffrey-Diamond, Ltd. The rating was given as 700 A at up to 650 V; actually it is designed for 100 A.

Parliamentary News (BY OUR SPECIAL REPORTER)

"Pylons" and Air Attack

In the House of Commons on November 24th Mr. Tinker asked the Minister of Transport if he were aware that the pylon system of carrying electric wires did not improve the appearance of the country and that in the case of air attack it would be vulnerable, and, in view of this, if he would have an examination made of the whole position to see if it were more practicable and safer to convey the electricity underground.

Mr. Burgin said the answer was in the negative. The matter had already been carefully examined and, having all considerations in mind, he was satisfied that the hon. member's suggestion was not practicable.

Welsh Village Supplies

Mr. Guest asked the Minister of Transport whether he would state the number of villages in Breconshire and Radnorshire to which a supply of electricity had not been extended.

Mr. Burgin said that the number was 128.

Overcrowding on the Underground

Sir R. Blair asked the Minister of Transport if his attention had been directed to the recent increase of overcrowding on the Edgware and Morden tube, particularly between Golder's Green station and the West End, and that the time-table had been altered and trains were less frequent, and if he would make representations to improve such conditions, especially at the rush hours.

Mr. Burgin said he was informed by the London Passenger Transport Board that the service from Golder's Green to the West End was recently increased during the morning peak hours by two trains. Compared with last winter, this service shows a total increase of four trains and the service from Edgware an increase of two trains. As regarded the number of trains, this line was now worked to its full capacity. The Board was not aware that there has been any general increase of the overcrowding which existed during certain hours owing to the fact that the majority of passengers travelled at about the same time in the morning and evening.

Underground Telephone Cables

Sir R. Glyn asked the Postmaster-General what progress had been made with laying underground cables, what mileage had so far been dealt with during the last twelve months, and by what date the whole scheme would be completed.

Major Tryon said that on September 30th, 1937, the total underground single-wire mileage was nearly 12¼ million miles as compared with just over 11¼ million miles on September 30th, 1936. Further cables would be required year by year so long as the telephone service continued to develop; development was still going on at a rapid pace and it was impossible to foretell a date when saturation point would be reached.

Steel Shortage

Sir J. Mellor asked the President of the Board of Trade if he would make a statement with regard to the shortage of steel billets for re-rolling.

Captain Wallace said that although home production of billets was steadily increasing it was not yet sufficient to meet all demands. All re-rolling firms were members of the National Association of Rolled and Re-rolled Steel Products, which was affiliated to the British Iron and Steel Federation. Arrangements had been made between the Association and the steel makers for the allocation of the available home supplies, and the Federation had also arranged for additional quantities to be imported from the Continental Steel Cartel as well as from America. The present difficulties of certain re-rolling firms were due to delays in the delivery of steel billets purchased from abroad by the British Iron and Steel Federation for distribution to re-rollers, but he was informed that a considerable improvement in the position might be expected within a very short time.

Interference with Radio

Mr. Parker asked the Postmaster-General whether he was aware that wireless listeners in South Essex suffered considerable interference from faulty apparatus at the Lodge-Cottrell electrical precipitation plant at Tilbury.

Sir W. Womersley said that numerous complaints had been received of interference with radio reception in South Essex. The cause had recently been traced to a defect in certain plant operated by a cement company at West Thurrock. He understood that the company had undertaken to remedy the defect at the earliest practicable date and that the manufacture of the necessary apparatus had already been commenced.

Rural Supplies

On November 29th Mr. De La Bere asked the Minister of Agriculture what steps the Government were taking to ensure a cheap supply of electricity for the farmers throughout the country further to assist them to keep their production costs as low as possible.

Mr. Ramsbotham, who replied, said that the Government had decided to adopt, in principle, subject to certain modifications in detail, the recommendations of the McGowan Committee for a reorganisation of electricity supply. The legislation would be directed among other matters to facilitating and expediting electrical development in rural areas.

Profits of Undertakings

Mr. Batey asked the Minister of Transport if he could give the profits of all electricity undertakings in Great Britain for the years 1935 to 1936.

Mr. Burgin said that the figures for the gross surplus of authorised electricity undertakings (public authority and company undertakings) in Great Britain and for the appropriation thereof in the year 1935-36 were as follows:—Gross surplus, £38,970,107; appropriation of gross surplus: (i) interest and dividends £15,813,712, (ii) depreciation, &c., funds, debt redemption and other purposes, including balances, £23,156,395. The figures for the year 1936-37 were not yet available.

B.B.C. Contracts

Mr. De La Bere asked the Postmaster-General whether he could say if all the contracts entered into by the British Broadcasting Corporation were put out to public tender from time to time.

Major Tryon said he was informed by the British Broadcasting Corporation that its normal practice was to invite competitive tenders for its requirements from firms likely to be able to supply them.

In the Courts

Grampian Company Fined

The Grampian Electricity Supply Co. was fined £30 at Perth Sheriff Court on November 23rd for an offence under the Factory and Workshops Act at its generating station at Tummel Bridge, Perthshire. On behalf of the company, a plea of guilty was tendered to a charge of having neglected to protect in a cubicle a live terminal or terminals of an electric circuit carrying current at 250 V so as to prevent danger, so far as was reasonably practicable, in consequence of which neglect James Hunter McLay, Stenhousemuir, who was working inside the cubicle, received a fatal electric shock.

An agent, representing the company, explained that the cubicle was situated in an area which was set apart for a particular purpose, and only authorised persons, or persons acting under their supervision, were allowed to enter the area. The cubicles were kept locked, and when locked no live wires or terminals were exposed. The cubicle was unlocked for the purpose of carrying out particular work. McLay was a skilled electrician in the employ of the British Thomson-Houston Co., who had a contract with respondents. Before work was commenced employés of the Grampian Co. had indicated to the foreman that the terminals were live. The agent quoted from the manager's report, which stated that a workman found McLay lying with his head in the cubicle. He reported this and some of the men rushed up and pulled McLay clear of the cubicle and started to apply artificial respiration, under the impression that he had fainted. While they were doing so they discovered burns on his left arm and ear. Apparently deceased's arm had been in contact with a terminal.

Continuing, the agent said the company had taken every precaution that was humanly possible, but it could not take precautions against the unforeseen. Whether the man had fainted owing to the heat of the day and had fallen against the terminal, or whether he had accidentally made contact with it, was not known.

The Fiscal said that he had received instructions from the Home Office to prosecute. The size of the cubicle was of some importance because it showed what a cramped position deceased was bound to work in. The door was only 15 in. wide and 21 in. in depth, so that the man's whole body could not get inside the cubicle. He had to work lying on his side. He thought more adequate protection could have been given, quite apart from any question of insulating the terminals completely. The current might have been cut off while the men were working there.

Sheriff Valentine said that respondents were liable to a fine of £100. That, however, was the penalty for the maximum amount of negligence, and his Lordship did not think that was the case here, but he thought that if all reasonable precautions had been taken the accident might not have happened.

Batti-Wallahs' Society

The next monthly luncheon of the Batti-Wallahs' Society will be held on December 10th at the Hotel Victoria, when Lord Alness, a Scottish judge, will be the principal speaker and will recount some of his experiences. Tickets will shortly be available for the annual dinner and dance at Grosvenor House, Park Lane, on March 18th, 1938.

Business and Industrial Notes

The Week's News. Showrooms and Exhibitions. New Installations. Overseas Trade. Publicity Material. Trade Announcements. Prices of Materials. Liquidations and Bankruptcies.

Anglo-American Trade Negotiations

Lord Hirst, president of the Federation of British Industries, has forwarded to the President of the Board of Trade a letter in which a request is made that any British industries which are likely to be affected by concessions made in the British tariff as the result of trade negotiations between this country and the United States should be given the earliest opportunity of stating their case before a decision is taken. It is pointed out that under American procedure the American manufacturer is entitled to get similar information at a very early stage in the negotiations, and the Federation feels that the British manufacturer should have the same advantage.

Lighting a Cocktail Bar

Attractive ideas for decorative lighting are to be found at the Ladies' Carlton Club, 5, Grosvenor Place, S.W.1, where a new cocktail bar has just been opened. Circular plaques of frosted glass bearing figures of dancers have been let into the wall behind the counter and from these comes a soft and restful light, which is supplemented by illumination from a metal and glass standard with a fabric shade, a wall bracket, and a semi-circular alabaster bowl over the doorway. In the adjoining lounge the main illumination emanates from concealed lamps round the top of the windows and from two imposing hexagonal standards mounted at the head of the spiral staircase leading to the old cocktail bar, and on the rail of a small gallery. The installation was carried out by A. O. Gibbons, Ltd.

Advertising by Films

The modern publicity film gains the attention of the audience by themes and "angles" having unquestionable entertainment value which is in no way impaired by the subtle introduction of advertising matter. Typical of this new treatment a series of some of the latest productions was shown at a trade show given jointly by Publicity Films, Ltd., and Sound Services, Ltd., at the Palace Theatre, Shaftesbury Avenue, W., on November 25th. Two of the films, intended for ordinary cinema audiences, showed how certain matters of electrical interest could be dealt with. "Preserved History" (Lightfoot Refrigeration, Ltd.) traced the history of food preservation from the days of the cave dweller to the twentieth century with its Westinghouse refrigerator. How Joseph Lucas, Ltd., produces the numerous electrical components which combine to ensure the reliability and safety of the modern motor-car was demonstrated by another film entitled "Electricalities." This sort of publicity has great possibilities.

Teaching Radio Communication Engineering

To keep abreast of the developments in radio communication it has recently been necessary to carry out considerable extensions to the facilities provided by the Marconi School of Wireless Communication at Chelmsford. Adjoining the old building in Arbour Lane (which has been modernised and is used as a hostel for students) there has been erected a school building designed on modern lines, with the most up-to-date equipment, providing experimental, research and standards laboratories and a lecture theatre for about seventy, as well as offices. Accommodation is now provided for between 100 and 150, three different classes of students being catered for: probationer engineers at the Marconi Works, representatives of purchasers of Marconi apparatus, and private students. Only students who have obtained an engineering or electrical degree elsewhere or who pass an examination to show that they have reached a certain standard of theoretical studies are accepted. The normal course lasts five months, but an advanced syllabus is available for those who wish to continue their studies. The work is to a very large extent directed to the experimental and research side and an outstanding feature of the methods of instruction employed is that students have the solution of various problems merely indicated to them and are left to devise the best ways of tackling them.

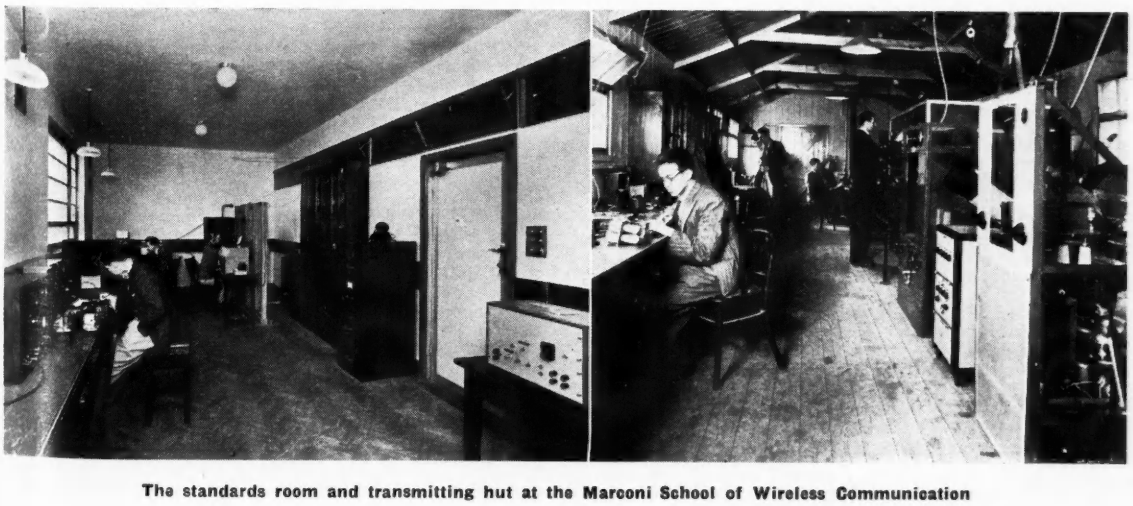
Fluorescent Lamps for Hackney

Hackney Borough Council claims to be the first authority to go in for the new fluorescent mercury-vapour lamps mentioned on page 777 of this issue. Last Wednesday it placed an order for thirty-six of the "Osira" 400-W type for lighting Rectory Road and Stoke Newington Common. The lamps will be spaced at 150 ft., the mounting height being 25 ft.

The stand of the Metropolitan-Vickers Electrical Co., Ltd., at the Cardiff Engineering Exhibition which concluded last Saturday

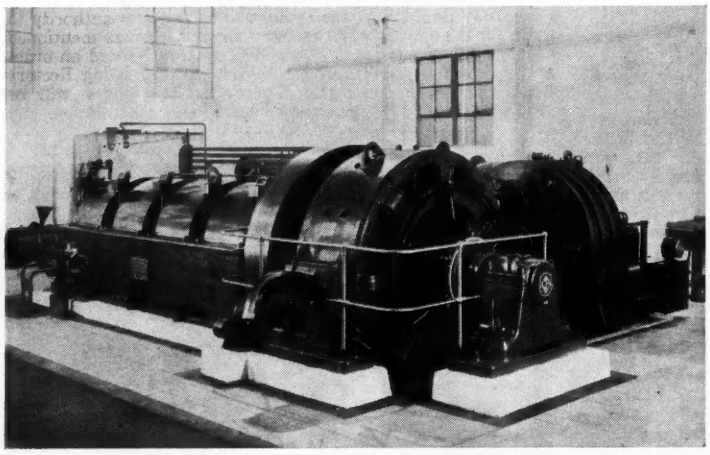
"Metesco" Jubilee

On November 26th, 1887, a company was registered with the title South Metropolitan Electric Supply Co., Ltd., and in the following year its name was changed to the Metropolitan Electric Supply Co., Ltd. On Friday last the company celebrated its jubilee by giving a dinner at Porchester Hall, Bayswater, at which over 800 members of the staff and employés of the company and its associated companies attended, presided over by Mr. W. H. Chapman. The toast of "The Company" was proposed by Mr. A. F. Dauncey, who has been with the company for over forty years. He said that their first generating station was constructed at Whitehall Court under a roadway and consisted of three sets of Willans engines coupled to Clark Muirhead dynamos, each of 60 kW. At the end of 1888 the total sales amounted to approximately 10,000 kWh. As a result of their first fifty years, to-day they had 180,000 consumers and sold over 400 million kWh per annum, and no company in London was selling electricity for lighting at a lower rate than they were. As part of their service to consumers, the company had financed the hire of 35,000 pieces of apparatus, which were maintained by their staff. All that was now



The standards room and transmitting hut at the Marconi School of Wireless Communication

desired was that "Metesco" should be allowed to carry on its good work unfettered by grandmotherly legislation. The chairman, Mr. G. Balfour, M.P., in responding to the toast referred to the co-operation which existed between all the directors, the staff and the workpeople. He thought that their jubilee celebrations might have been deferred until February next year, when the Notting Hill Company, their latest acquisition, would celebrate its jubilee. Mr. Balfour said it was fifty years ago since he started in the electrical workshop; he was able, therefore, to speak with experience. It was interesting to-day to think of the rapid development of the electricity industry. He questioned the advisability of putting the industry under the control of certain Government institutions. The development of electricity supply in Great Britain had been a great romance, but this romance would not continue under the control of the Electricity Commissioners and other Government authorities. The toast of "The Guests" was proposed by Mr. D. T. Pugh, to which Mr. G. Blackwell (a director) responded. Mr. T. W. Lee proposed "The Management."



New plant at the works power station of Crompton Parkinson, Ltd.

French Domestic Electrical Trade

The appended table shows the French imports and exports of domestic electrical appliances during the first half of the current year, as compared with the corresponding six months of 1936. The French franc values have been converted to sterling at 147 to the £. As will be seen both sections of the trade show a larger total, imports having advanced by £30,245 and exports by £15,841.

IMPORTS.	January to June, 1936.	1937.
	(1,000 fr.)	
Electric fires and stoves	2,440	2,656
Electric irons	23	185
Electric vacuum cleaners, boot cleaners, etc. ...	1,363	3,038
Electrical refrigerators, etc.	5,675	7,887
Electric fans	98	279
Total fr.	9,599,000	14,045,000
Total at 147 fr. to £	£65,299	£95,544
Total exports all classes of domestic electrical appliances ... ... fr.	4,288,000	6,618,000
£	29,180	45,021

The Electrical Fireside

In the second column of our leading article last week, in line seven, we stated that one concern alone was "responsible for as many as 800 per week." This, of course, should have read 800 per day, such being the output at the present moment. The aggregate production of electric coal fires by the industry is estimated at approximately 100,000 per annum.

Electricity Supply Rifle League

The annual dinner and prize distribution of the Electricity Supply Rifle League was held on November 20th in London under the chairmanship of Mr. W. Weekes (Shoreditch), supported by Messrs. E. A. Mills (Hackney), H. P. Gaze (London Power Co.), M. Farrer (J.E.A., Twickenham), C. F. McInnes (Gravesend), J. R. J. Bowden (Hackney), P. C. Ebner (Shoreditch), and S. G. Nodes (London Power Co.). During the course of the evening the honorary secretary reviewed the events of the year and dealt with the early days of the League twenty-five years ago. After the prizes had been distributed the toast of "The Chairman" was proposed by Mr. Ebner, who commented on his long association with Mr. Weekes, who was now retiring from the position of borough electrical engineer at Shoreditch. Mr. Weekes, in responding, mentioned that the first meeting of the League was held at Shoreditch twenty-five years ago and ever since they had the same secretary, Mr. Mathews, to whose energy much of the success of the League was due. The final leaders in the various divisions of the League are as follows:—First division: Barking "A." Second division: Brimsdown. Third division: Barking "B." Fourth division: Barking "C."

Fire at Research Laboratories

A fire occurred at the research laboratories of the General Electric Co., Ltd., at 6 a.m. on Sunday morning last. The night watchman became aware of a conflagration in the gallery which contains the cable and pipe-runs and other services to the radio and electrical appliance laboratories. The fire caught the roof of the gallery and spread along it, and about 300 ft. was burnt out. The experimental rooms of the laboratory proper were not seriously damaged by fire. Until the destroyed cables and services are reinstated these sections of the laboratory activity will not be running normally.

Single-bearing Generators

To meet the increased power demand at their Chelmsford Works, Crompton Parkinson, Ltd., have installed a new Crossley-Premier 550-b.h.p. 273-r.p.m. engine of the horizontal single-line type, pressure charged at three-quarters load by a Keith-Blackman blower. The blower, which supplies 1,550 cu. ft. of air per min., at 4.5 in. Hg., is driven by a 35-h.p., 2,250-r.p.m. Crompton Parkinson shunt-wound motor fed from the directly coupled 400-kW, 240-V d.c. generator. The generator is one of Crompton Parkinson's new range of pedestal-bearing machines, which has been developed in collaboration with leading engine makers in this country to enable consideration to be given to individual requirements and to reduce the overall length of the set to a minimum. There is only one pedestal bearing, which is of the self-oiled type with two lubricating rings and is designed to support the heaviest flywheel without the need for an outboard bearing to the engine, so that a great proportion of the engine's flywheel weight can be taken on the generator bearing. The large-diameter shaft has its flange forged integrally to form the half coupling. The brushgear is frame-mounted and the brush-holders are individually removable from the brush arms; during inspection the radial pressure springs are automatically released.

The Leipzig Fair

The significance of electro-technical products is very forcibly demonstrated in the Engineering and Building Trades Section at the Leipzig Fair. Here the whole of the German engineering industry is represented, more than 3,000 of the leading manufacturers exhibiting. The various branches in electrical engineering include twenty-four manufacturers of electric motors, twenty-one of high-voltage materials and insulators, twenty-nine of switchgear, nineteen of measuring instruments, thirty-one of telephone apparatus, 165 of installation materials for high and low voltages, and forty-six of radio apparatus. It is to be expected that the forthcoming Technical Fair at Leipzig to be held from March 6th to the 14th, inclusive, will register a still greater number of exhibitors, as the electro-technical hall is to be extended and will have an annexe attached to it. Foreign countries supply a very large proportion of the visitors to the Fair, and the number has increased from 15,523 in the spring of 1933 to 31,684 in the spring of this year, when 2,422 were from Great Britain. The interest shown by English buyers in the electro-technical displays is evidenced by the number of orders placed by them, particularly for installation and insulating materials. The Technical Fair presents a comprehensive insight into a highly developed industry, and provides a means for the furthering of mutual relations and exchange of goods, in which latter German industry has also a very considerable interest.

Social Events

On November 26th the Lewcos Dramatic Society (London Electric Wire Co. & Smiths, Ltd.), presented "Mystery at Greenfingers," at the Guildhall School of Music and Drama Theatre. The play, produced by Denis Moores, was specially written by Mr. J. B. Priestley for the *News Chronicle* Amateur Dramatic Contest, in which the Society is competing. In consequence, the whole show had to be built up, a task not too easy for an amateur society but one which put the Lewcos Society on its mettle. The result was an excellent evening's entertainment. Each character was well portrayed. Neil MacGregor, as a French cook, gesticulated through his part in fine style, and Marion Craddock, Joan Brookman and George Sinclair showed a real sense of humour. The dramatics were efficiently provided by Lillian House. Others of considerable ability were Sidney Graefe, Maisie Runchman, Marjorie Goodram and Robert Smith. Congratulations must also go to Eleanor James, who was "co-opted" at short notice.

The annual dinner of the Southend Corporation Electricity Department was held on Monday last at Garron's Banqueting Hall, and was presided over by Mr. A. C. Johnson, the borough electrical engineer and manager. The toast of "The Guests" was proposed by Mr. J. Linton, chief assistant to Mr. Johnson, and Ald. H. A. Dowsett (the Mayor) in replying, said that 1¾ millions was invested in the electricity undertaking. It was the policy of the Electricity Committee to make the advantages of electricity available to all, and not to make large profits. The toast of "Our Undertaking" was proposed by Ald. S. F. Johnson (chairman of the Electricity Committee),

who said it was twenty-five years since he first became connected with the undertaking. He did not know what the future of the undertaking would be. Critics had described it as being badly managed, but this was not true, and he thought when the Government scheme came into operation the proper value of the undertaking would be shown. Referring to domestic development, he claimed that the undertaking topped the list in the country in the output of water heaters. The scheme of illuminations had also been criticised, but he thought they were the finest thing that had been done to popularise the town as a seaside resort. He did not know, however, whether they would have them again. Mr. A. C. Johnson, in responding to the toast, spoke of the progress made by the Department. In five years the output had been trebled while the price per kWh had been halved. They had spent £150,000 on the change-over scheme; the cost to-day would be considerably greater. Mains were laid in all streets except the remote parts of the borough, and the task now was to see that they were loaded up. He considered that the undertaking was over-rated, as between 11 and 12 per cent. of the total income was paid in rates or contributions to the rates. The cost of the illuminations had been met by the visitors to the borough. He paid a tribute to the staff to whose work, he said, the success of the Department was due. During the evening the cups for the various championships of the sports clubs were presented to the winners.

Female Works Apprentices

On November 25th Sir Felix Pole opened a challenge debate between the College and School Section of the Metro-Vick Apprentice Association and the M-V Debating Society. The College and School Section proposed a motion "that the Introduction of female apprentices to these works is to be deplored," and the Debating Society opposed it. An effective contribution to the opposition speeches was made by Miss Garfit, B.Sc.Tech., who has recently been accepted by the company for the College apprenticeship course. The motion was lost by seventy-eight votes to sixty-one.

Sir Felix Pole opening a debate between the College and School Section of the M-V Apprentice Association and the M-V Debating Society

An Aluminium Information Bureau

An Aluminium Information Bureau has been formed, with offices at Bush House, Aldwych, London, W.C.2. Conducted by the Northern Aluminium Co., its objects are to provide potential users with information upon the possible uses of aluminium in their own particular sphere. It is intended to publish from time to time data concerning research, new developments in aluminium alloys, and details of their employment in all types of engineering, architecture, building construction and decoration.

Cables in the Antarctic

The rigours of the Antarctic, including a temperature which varied from −20 to +70 deg., failed to disturb the normal performance of the Callender cable which was part of the equipment of the British Graham Land Expedition 1934-37. For two years the cable, used for power distribution actually within the Antarctic Circle, was subjected to this test. The officer in charge of the expedition's radio stations has reported that the insulation of the cable was in no way adversely affected by the range of temperature. The performance of the cable used for connecting the cells was equally satisfactory; the conductors were not corroded by chemical action during charging. A duplicate set of cable was supplied, but was never used, the performance of the original set being entirely satisfactory over a period of two years. The cable was used for the distribution from the d.c. dynamo to the switchboard of the charging set, accumulators, radio transmitter and electric lighting distribution board; also for cell connections on accumulators. The normal charging current was 28 A, and the peak lighting load 9 A at 32 V. The cable consisted of 350 yd. of single conductor "Ancalite" insulated, varnished silk taped, cotton braided and waxolene compounded, and 350 yd. of single conductor v.i.r. insulated (G.D.E. 60 per cent.). The dynamo and batteries were housed in an unheated porch, the variation in temperature mentioned above being the night period (lowest) and when the petrol engine was driving the dynamo (highest).

Utilities Power Report

Mr. J. L. Houghteling, who was appointed by an American federal judge to investigate the affairs of the Utilities Power and Light Corporation, has submitted his report. According to the *Electrical World* this states that Mr. Floyd B. Odlum had offered about $17,000,000 for the company's British properties, whereas they were actually worth $25,000,000. "Stating that the persons controlling interests in the corporation were more interested in finance than in public utility operation, Mr. Houghteling said that the fundamental relationship between producer and consumer, based on actual delivery of electricity and other products, apparently had been lost sight of among the many corporate forms and securities in the involved corporation."

Lancashire Dynamo Activity

Lancashire Dynamo & Crypto, Ltd., reports a continued high level of home and overseas orders. Overseas business includes many machines for Russia and Burma, while Australia and South Africa are also good markets. For the Home market there are many machines for the Admiralty, also for printing electrification work, food preparing machinery, and machines for boiler-house plant.

Rawlplug Publicity

The Rawlplug Co., Ltd., has sent us copies of a number of advertisements which will appear prominently in the national Press during 1938. These draw attention to some of the many industrial applications of "Rawlplugs."

Electricity in Spring-making

In the article bearing this title in our issue of November 19th we mentioned the "Humbarton" distribution line. Actually the correct name is "Humburton" and this overhead bus-bar system is a product of the English Electric Co., Ltd.

Prices of Materials

The following prices are only general, and they may vary according to quantities and other circumstances:—

CHEMICALS, ETC.	Price. December 1st.	Fortnight's Inc. or dec.
a Acid Oxalic ... ... per cwt.	50s.	—
a Ammoniac, Sal ... ... per ton	£36	—
a Ammonia, Muriate (large crystal)... ,,	£18 10s.	—
a Borax ... ... ,,	£17	—
a Copper, Sulphate ... ... ,,	£22 10s.	—
a Potash, Chlorate ... ... per lb.	3¾d. to 4¾d.	—
a ,, Perchlorate ... ... ,,	6d.	—
a Shellac ... ... per cwt.	£4 18s.	—
a Sulphur, Commercial ... ... per ton	£11	—
a ,, Roll ... ... ,,	£11	—
a Soda, Chlorate ... ... per lb.	3¼d. to 3¾d.	—
a ,, Crystals ... ... per ton	£5 to £5 5s.	—
a Sodium Bichromate, casks ... ... per lb.	4d. net.	—
METALS, ETC.		
b Aluminium, Ingots ... ... per ton	£100 to £105	—
b ,, Wire ... ... per lb.	1/1 to 1/9	—
b ,, Sheet and Foil... ... ,,	1/3 to 2/9	—
p Babbitts Metal and Anti-friction Metals—		
Grade I ... ... per ton net	£176	£14 dec.
Grade II ... ... ,,	£125	£10 dec.
Grade III... ... ... ,,	£72	£5 dec.
c Brass (rolled metal 2" to 12" basis)... per lb.	8¼d.	¼d. dec.
c ,, Tubes (solid drawn) ... ... ,,	11¼d. to 11½d.	—
c ,, Wire, basis ... ... ,,	8¾d.	¼d. dec.
e Copper Tubes (solid drawn) ... ,,	1/0½	—
g ,, Bars (best selected) ... per ton	£76	£2 dec.
g ,, Sheet... ... ... ,,		
g ,, Rod ... ... ,,		
d ,, (Electrolytic) Bars ... ... ,,	£45	£1 dec.
d ,, ,, Wire Rods ... ,,	£50 10s.	£1 dec.
d ,, ,, H.C. Wire ... per lb.	8¼d.	¼d. dec.
f Ebonite Rod ¼" dia. & up ... ... ,,	1/10 to 2/5	—
f ,, Sheet ⅛" thick & up ... ,,	1/5 to 1/10	—
n German Silver Wire, Nos. 1 to 12... ,,	2/4	—
h Gutta-percha, fine ... ... ,,	nom.	—
h India-rubber, Para-fine ... ... ,,	7¼d.	¼d. dec.
i Iron, Pig (Cleveland, No. 3) ... per ton	£4 5s.	—
i ,, Wire galv. No. 1 P.O. Qual.... ,,	£23	—
g Lead, English Pig ... ... ,,	£18	£1 10s. dec.
g Mercury ... ... per bot.	£13	—
e Mica (in original cases) small ... per lb.	10d. to 2/-	—
e ,, ,, ,, medium ... ,,	6/- to 12/6	—
e ,, ,, ,, large ... ,,	13/- to 17/6 up	—
p Phosphor Bronze, plain castings ... ,,	1/2½	¼d. dec.
p ,, ,, drawn bars & rods ,,	1/1½	¼d. dec.
p ,, ,, rolled strip & sheet ,,	10½d.	¼d. dec.
p ,, ,, wire ... ... ,,	1/0½	¼d. dec.
o Platinum ... ... per oz.	£8 5s.	10s. dec.
d Silicium Bronze Wire ... ... per lb.	8½d.	¼d. dec.
g Spelter ... ... per ton	£15 7s. 6d.	15s. dec.
g Tin, Block (English) ... ... per ton	£185	£3 dec.
n ,, Wire, Nos. 1 to 16 ... ... per lb.	4/3	—

Quotations supplied by:—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India Rubber, Gutta Percha and Telegraph Works Co., Ltd.
g Henry Gardner & Co., Ltd.
h Edward Till & Co.
i Bolling & Lowe.
n P. Ormiston & Sons.
o Johnson Matthey & Co.
p C. Clifford & Sons, Ltd.

A Cooker Window Display

In our last issue we reproduced a photograph sent us by Falk, Stadelmann & Co., Ltd., of a window display incorporating one of their "Surves" cookers. We are now informed by the company that this display was not at Bargoed as they stated, but at Barking and was arranged by the Corporation Electricity Department.

Price Increase

Dorman & Smith, Ltd., announce that owing to further wages increases they have advanced their prices by 5 per cent., making a total of 20 per cent., on list prices. This advance does not apply to the lighting fittings, &c., illustrated in catalogue L.F. 127.

New Catalogues and Lists

British Aluminium Co., Ltd., King William Street, London.—We regret that the company's publication "Aluminium in Architecture," mentioned on page 646 of our issue of November 5th was in error attributed to the London Aluminium Co.

British Insulated Cables, Ltd., Prescot.—Leaflets dealing with outdoor inverted terminal boxes, stove and range wire, enamelled wire, "Rockbestos" flexibles, jointing materials, unkinkable flexibles, lead seals and sealing pliers, spot welders, service cut-outs, and plumber's metal.

D. G. E. Barrie, 24, Middleton Avenue, Hove.—A catalogue of electric lighting fittings.

Constructors, Ltd., Nickel Works, Tyburn Road, Erdington, Birmingham.—A leaflet dealing with "Adjusteel" shelving.

Alkium Storage Batteries, Ltd., Waterside, Halifax.—An illustrated art booklet dealing with steel batteries for marine use.

Electrical Components, Ltd., 102, Snow Hill, Birmingham, 4.—A catalogue of reflectors for industrial lighting.

P. L. Dwyer & Co., 30, Grosvenor Place, London, S.W.1.—A trade catalogue, with prices, of cables, conduits and electrical accessories.

Price & Belsham, Ltd., Tamworth Lane Works, Mitcham.—A pamphlet dealing with a long scale switchboard pattern load indicator.

J. M. Webber & Co., Ltd., 39, Great Eastern Street, London, E.C.2.—A 120-page fully illustrated catalogue of cables, radio, and electrical equipment.

Spencer Wire Co., Ltd., Wakefield.—A booklet on high conductivity copper wire, strip, rod and strand.

Siemens Electric Lamps & Supplies, Ltd., 38-39, Upper Thames Street, London, E.C.4.—New publication dealing with earth leakage circuit-breakers, switch-fuses and cooker control units and high rupturing capacity "Zed" cartridge fuses.

Bankruptcy Proceedings

S. L. Bapty and **N. Miles** (Wireless Instrument Manufacturing Co.), Avenue Works, Avenue Road, Willesden Junction, N.W. (separate application of S. L. Bapty).—Application for discharge to be heard on December 15th at Carey Street, W.C.2.

D. P. Phillips, radio dealer, Cartrif, Talog.—Last day for receiving proofs for dividend December 10th. Trustee, Mr. H. W. Thomas, 4, Queen Street, Carmarthen.

A. B. Bowe, radio, cycle and electrical dealer, 10, Scotland Road, Penrith, lately trading at Corney Square, Penrith.—Last day for receiving proofs for dividend December 7th. Trustee, Mr. T. B. Harston, 18, Bank Street, Carlisle, Official Receiver.

E. M. Swift, electrical engineer, 10, Joinings Bank, Langley Green, Worcester.—First and final dividend of 2¾d. in the £, payable November 30th at 159, Great Charles Street, Birmingham.

C. Douse (Clifford Radio), radio dealer, 118, Sneinton Dale, Nottingham.—Receiving order made November 22nd on debtor's own petition.

F. G. Simcock, electrician, "Ferndale," Balcarres Road, Leyland, lately trading at 68, Burton Road, West Didsbury, Manchester.—Order dated October 25th, 1937, granting discharge forthwith.

E. Aveyard (Alpha Electric Co.), electrical engineer, 14, Arnold Avenue, Hyde, lately trading at 60, Market Street, Stalybridge.—Trustee, Mr. P. M. Milward, Byrom Street, Manchester, Official Receiver, released November 16th.

E. A. V. Burton, electrical engineer, 14, St. Peter's Park Road, Broadstairs.—Last day for receiving proofs for dividend December 11th. Trustee, Mr. F. C. Wells, 1, The Parade, Canterbury, Official Receiver.

P. A. Manley, radio dealer, 136, Ashton New Road, Manchester.—Last day for receiving proofs for dividend December 11th. Trustee, Mr. F. H. Langmaid, Byrom Street, Manchester, Senior Official Receiver.

J. Conlon, electrical engineer, 18, Buckingham Street, Hull.—First and final dividend of 2s. 2d. in the £, payable November 29th at 1, Parliament Street, Hull.

E. Mankellow, electrician, 2, Holly Cottages, Ascot Place, Ascot.—Discharged as from November 26th, 1937.

Company Liquidations

Hellyar & Sons, Ltd., 169, Church Road, Barnes, Surrey, electricians.—The first meetings of creditors and shareholders were held at Carey Street, London, W.C., on November 24th, under a winding-up order dated October 18th last.—Mr. H. P. Naunton, Official Receiver, reported that the company was incorporated in July, 1912, with a capital of £2,000, to take over the business carried on by Mr. T. H. Hellyar. Accounts prepared showed that for the year ended June 30th, 1935, there was a net profit of £199 on a turnover of £7,621, and in the next year there was a profit of £255 on sales of £5,461. From July 1st, 1936, to the date of the appointment of the receiver for the debenture holders, in July last, there was a turnover of £10,310, a gross profit of £2,038 and a net loss of £191. Dealing with the statement of affairs the chairman stated that the gross liabilities of the company amounted to £3,766, of which £2,906 was due to unsecured creditors. The assets were estimated to realise £1,639. According to the Receiver's accounts it appeared that as at November 19th the estimated assets still to be realised totalled £723. That figure, however, included book debts of £538, the value of which was problematical. The Receiver had paid off the debenture principal of £400, and estimated that including accrued debenture interest amounting to £245 his further payments would total £338, subject to cost of realisation. The affairs of the company were left in the hands of the Official Receiver.

Electro Chemical Processes, Ltd.—Particulars of claims by December 11th to the liquidator, Mr. A. E. Dunnill, 113, Kingsway, W.C.2.

Delabole Electric Lighting & Supply Co., Ltd.—Meeting January 5th at the Liberal Club, Delabole, to receive an account of the winding-up by the liquidator, Mr. A. J. Kellow.

Electric Super Service Co., Ltd.—Winding up voluntarily. Liquidator, Mr. J. B. Belcher.

Deacons Radio, Ltd.—Winding up voluntarily. Liquidator, Mr. H. Rainsbury, 133-139, Finsbury Pavement, E.C.

Dissolution of Partnership

City Radio, radio dealers, Market Street, Fenton, Stoke-on-Trent.—Messrs. R. Young and N. Foster have dissolved partnership. Mr. Foster will attend to debts and carry on the business.

E.C.A. (Manchester Branch) Dinner

A PLEA for closer co-operation between electrical contractors, supply authorities and manufacturers was made by Mr. J. S. Peck, M.I.E.E., Fellow A.I.E.E., a director of Metropolitan-Vickers Electrical Co., Ltd., at the annual dinner of the Manchester Area branch of the Electrical Contractors' Association at the Midland Hotel on November 23rd. Owing to the absence of Mr. L. E. Wilson, through illness, Mr. S. Dickinson, vice-chairman of the branch, presided. Mr. Peck said that the whole of the electrical industry was prosperous and when an industry was prosperous there were always a lot of people who were ready to rush in, cut prices and destroy the work of those who had played a leading part in establishing the industry. It was not right that the electrical contractor who had spent the best part of his life in building up a business connection, and who had expended much time and money in advertising electricity, should not be allowed to reap the harvest to which his enterprise entitled him. There must come a time when destructive competition would be brought under control. It was not good either for business or for the country that any undertaking, large or small, should be run without profit. If the profits were too high it could be depended upon that the Government would soon intervene. Difficulties had arisen between electrical contractors and certain supply authorities and manufacturers. What they were he was not able to discuss, but the industry would go farther and faster, if the three worked together harmoniously. Contractors should put their house in order and make their organisation so strong that others would prefer to work with them rather than against them.

Mr. J. Harcourt Williams, deputy chief engineer of the Manchester Corporation Electricity Department, said that there were about sixty contractors out of 300 in the local branch of the E.C.A. This was neither satisfactory to the E.C.A. nor to the Corporation, which certainly desired big-scale co-operation. The work to be done in Manchester was securing increased use of electricity by existing consumers. This meant greater use of appliances and a great deal more wiring. That was the electrical contractors' job. In Manchester there were 205,000 houses available for connection to the mains, but only 140,000 had so far been wired, so that there was still much work to be done. The Corporation had advertised in a persistent way, had held local exhibitions and paid out last year £80,000 to contractors for work done. Last year 20,000 new consumers were registered, and it was probable that that figure would be reached again this year. In the early part of next year the new electricity showrooms in the town hall extension would be opened. He hoped electrical contractors would make good use of this new facility and bring in consumers to inspect appliances. With regard to the forthcoming legislation based on the McGowan Report, he thought it must be regarded as a measure which would work out to the benefit of electrical contractors because one of the objects of the Bill was a cheaper supply of electricity. Cheaper electricity in Manchester was not so near as it was two years ago, owing to the enormous increase in the price of coal which in the current year would cost £70,000 more, and next year probably an additional £80,000. The coal selling schemes created under the Coal Mines Act, constituted one of the tightest rings in industry to-day.

Mr. J. H. Farthing (director, General Electric Co., Ltd.) said that much was heard to-day about the development of the domestic load in the North-Western Area—he was not referring to Manchester alone, where progress in the installation of cookers was much slower than elsewhere. There were groups of towns where the output of cookers and domestic appliances had actually been declining, whereas in the south of England it had been going ahead in an astonishing manner. There must be something wrong and he hoped thought would be given to correct this serious state of affairs.

Replying to the toast of the Electrical Contractors' Association, Mr. S. Dickinson said that they were still a long way from the all-electric age. He was glad to acknowledge that relations between the contractors and the supply authorities of Manchester and Salford had continued helpful and cordial.

Electricity Supply

Lighting, Domestic, Power

Aberdeen.—STREET LIGHTING.—The Lighting Sub-Committee has agreed to light St. Fittick's Road and also a section of Anderson Drive by electricity. Electricity has also been chosen for the lighting of the Middlefield housing estate.

Ashton-under-Lyne.—CHRISTMAS ILLUMINATIONS.—To-night the Mayor will switch on the decorative illuminations for the Christmas shopping season. All the main public buildings, including the town hall, baths, library and market hall, will either be floodlighted or embellished with fairy lamps.

Bradford.—PROPOSED LEGISLATION.—At a meeting last week of the Special Committee which is dealing with matters connected with the promotion of a Bill to secure the amalgamation of the Shipley urban district with Bradford the town clerk said that it might be necessary, if Shipley were added to Bradford, to promote a further Bill within the next two years to authorise the Corporation to undertake certain works. The electricity supply at Shipley might be affected by the Bill.

CHANGE-OVER.—The supply in the Otley Road, Barkerend Road and Leeds Road districts is to be changed over from d.c. to a.c.

NEW EQUIPMENT.—Plans of the Electricity Committee include the provision and equipment of a transforming station in East Parade and the installation of additional equipment at the Feather Road transforming station. New cables aggregating 5½ miles are to be laid at a cost of £10,369, involving 799 premises.

Colchester.—ENGINEER'S REPORT.—Commenting upon the increase of 2.3 million kWh in energy sold during 1936-37 (total, 20.7 million kWh), Mr. G. P. Dixon, the borough electrical engineer, remarks that this would have been better but for a fall in the supplies to two industrial consumers amounting to over 500,000 kWh. Fortunately, this substantial loss was made up by activity in connection with water supplies, as the Department secured new loads from the South Essex Waterworks and the Lexden and Winstree Rural District Council. There was a further reduction to 1.837d. in the average price obtained for all supplies. Consumers increased in number by 2,004 to 27,149. Considerable progress is recorded in the connection of domestic electrical apparatus. Additional electric cookers numbered 1,824, and the total in use at the end of the financial year was 8,017.

Croydon.—SUB-STATION.—The Electricity Committee is to provide a sub-station in the Portland Road area at a cost of £1,476.

MAINS.—The laying of mains in Addington, where the First National Housing Trust, Ltd., is about to proceed with the erection of 500 houses, is to be carried out by the Electricity Committee. An expenditure of £4,186 is involved. The Committee is also to provide a supply costing £936 to a factory which is being built in Purley Way by the London Pattern Co. A sum of £1,030 is to be spent on making an additional supply available to the Croydon Foundry, Purley Way.

Dunston.—TRADING ESTATE LIGHTING.—The accompanying photograph illustrates a temporary road-lighting installation which has been carried out by the Metropolitan-Vickers Electrical Co., Ltd., in Kingsway, Team Valley Trading Estate, for North-Eastern Trading Estates, Ltd. The contract included thirty-four units each comprising a 1,000-W "Metrovick Type B1" projector lamp in a floodlight projector, mounted on alternate poles on both sides of the road and facing with the traffic on each side. The installation work was sub-contracted to Watson-Norie, Ltd., of Newcastle-on-Tyne. The excellent lighting, without dazzle, given by this arrangement can be judged from the illustration. The floodlighting of the factory buildings seen on the left of the picture has also been carried out by the Met.-Vick. Co., which is now dealing with the permanent street lighting of the whole of the estate. This contract comprises 360 "Metrovick Kingsway" horizontal lanterns, each with a 400-W mercury electric-discharge lamp.

Temporary lighting installation at Kingsway, Team Valley Trading Estate

Ealing.—TARIFF REVISIONS.—Further concessions to domestic all-in tariff consumers have been approved. The standing charges are to be based upon the total external floor area instead of the rateable value as hitherto, and the "unit" charge is being reduced from ¾d. to ½d. In the case of consumers on the all-electric all-in tariff the charge will be further reduced to three kWh a penny after a consumption of 500 kWh per quarter. Hiring charges for cookers and water heaters are also being reduced. The changes take effect from and including the reading of the meters for the December quarter.

COOKER WIRING.—The borough electrical engineer recently reported upon the existing arrangements for wiring electric cookers let out on hire. After discussion the Electricity Committee came to the conclusion that it would be desirable to enter into a contract for twelve months with a local firm of contractors. The contract, however, is not to be applicable to cases in which the customer is introduced by an approved contractor.

Glasgow.—SUB-STATION.—The Riddrie Picture House Co., Ltd., is to erect a sub-station in Corson Street.

Hednesford.—CHRISTMAS LIGHTING SCHEME.—The Chamber of Commerce has decided to undertake a scheme of coloured electric lighting in the centre of the town for a fortnight before Christmas entailing the use of 1,620 lamps, which will be lighted from 5 p.m. to 11 p.m. each day.

Herne Bay.—STREET LIGHTING.—The Highways Committee has accepted the offer of the Herne Bay and District Electricity Supply Co., Ltd., to arrange for a film on street lighting to be shown in Herne Bay and also for a demonstration of colour-corrected mercury electric-discharge lamps to be given subject to approved arrangements.

Heston and Isleworth.—TWO-PART TARIFF DECISION.—The Council has decided to discontinue the new two-part tariff condition requiring the installation of an electric water heater or cooker.

Hull.—THE COAL POSITION.—A report by the city electrical engineer to the Parliamentary Committee last week indicated that when the present coal contracts expired the Electricity Department would be faced with a demand for more than an additional £100,000, the annual consumption being about 300,000 tons. It was left to the chairman, deputy chairman, town clerk and city electrical engineer to approach the local Members of Parliament and other municipal authorities on the subject.

Jarrow-on-Tyne.—LOW-VOLTAGE LINES.—The Town Council has provisionally approved plans of the North-Eastern Electric Supply Co., Ltd., for an underground low-voltage distribution cable along Humbart Street and a high-voltage cable in Tyne Street to Thomas and Greaves' works.

Kettering.—INSTITUTION LIGHTING.—Electric lighting is to be provided in the infirmary, portions of the house block and the east verandas of the Carey block at the Public Assistance Institution.

Lechlade.—INQUIRY.—A Ministry of Transport inquiry was held last week into an application by a number of consumers of the Wessex Electricity Co. for a reduction in the company's maximum prices. Mr. H. L. Ellwell, organiser of the petition, said it was considered that the present 7d. per kWh for lighting was too high. On behalf of the company it was stated that there was a uniform price over the whole area. The price was reduced in 1931 from 10d. to 9½d. and there were subsequent reductions until this year it was brought down to 7d.

Lichfield.—SALE OF UNDERTAKING.—It is reported that the Council has decided by a large majority to accept, subject to the consent of the Electricity Commissioners, the offer of the Walsall Corporation to take over the Lichfield electricity undertaking as from April 1st next.

London.—ST. PANCRAS.—For the purpose of affording an adequate supply of electricity to the Council's housing estates at Camden Park Road, Queen's Crescent and Leighton Road the Electricity Department is to provide a transforming station on each, and application is being made for sanction to a loan of £18,881 to cover the cost. In connection with this work the chief electrical engineer and manager has given consideration to the considerable expansion of the undertaking and the desirability of increasing the rupturing capacity of the high-voltage switchgear at the rotary sub-stations where, owing to the multiplicity of feeding mains entering these relatively large sub-stations, switchgear of higher rupturing capacity is most desirable. He suggests that the provision of the three new sub-stations presents the opportunity of trans-

ferring some of the high-voltage switchgear at the Tavistock Place and Highgate sub-stations, controlling 6,500 and 5,900 kW of plant, respectively, to the new sub-stations and replacing it by switchgear of adequate capacity. In the circumstances no provision for high-voltage switchgear is included in the estimate of the cost of the new sub-stations.

Referring to the mass cooking demonstrations in October, which incorporated a musical and humorous entertainment and were carried out in conjunction with the General Electric Co., Ltd., the report of the Electricity Committee states that a large number of orders was received as a direct result and that apart from this, and the potentialities of a canvass of the remainder of the audiences who have not yet placed orders, the undertaking has received valuable publicity, the results of which cannot be gauged at present. Votes of thanks have been passed to the chief engineer and manager, the commercial assistant, and other members of the staff.

POPLAR.—The Electricity Committee has considered a proposed tariff for consumers in private blocks of flats and recommends that the following be adopted: For cooker, water heater or wash-boiler, one lighting point per room and one plug point for radio set or radiator, a fixed charge of 1s. per week with a " unit " charge of 1d.

STOKE NEWINGTON.—Members of the Highways Committee recently inspected the experimental lighting for side streets installed in Portland Rise and Queen Elizabeth's Walk. After careful consideration it was decided to recommend that a system of 80- and 125-W mercury electric-discharge lamps similar to those in Portland Rise should be adopted for the lighting of side streets in the borough and that the borough engineer and surveyor should be instructed, as and when opportunity occurs, to prepare schemes for submission to the Committee.

Manchester.—SUB-STATION PLANT.—The Electricity Committee is seeking sanction to borrow £50,000 for consumers' sub-station plant.

Salford.—TARIFF CHARGES.—New all-in rateable value tariffs for shops and combined shops and houses have been approved by the Light, Heat and Power Committee. For the former the fixed quarterly charge is 6¼ per cent. of the rateable value of the premises (minimum charge £1 per quarter), and for the latter 5 per cent. of the rateable value (minimum £1 5s. per quarter), with a running charge of ⅜d. in each case. It is also proposed to amend the all-in domestic rate running charge, which at present is ⅜d. for the first 200 kWh per quarter and thereafter ½d. The new charge will be ½d. in the winter, with a reduction in the summer to ¼d. after the first 400 kWh per quarter. Other concessions include a reduction of the special electric vehicle battery charging rate to ¼d. per kWh and of that for supplies other than lighting to places of worship to ⅜d. per kWh. The charges take effect from the meter readings at the end of the December quarter.

Sheffield.—EXTENSION OF AREA.—Notice is to be served on the Yorkshire Electric Power Co. of the intention of the Corporation to exercise the option to acquire from the company so much of its undertaking as lies within the portion of the former township of Tinsley added to the city by the Sheffield Extension Order, 1921.

LOANS.—The Electricity Committee is seeking sanction to borrow £50,400 for mains, transformers and switchgear required for the bulk supply of electricity to Brown Bayley's Steel Works, Ltd.

Stoke-on-Trent.—FINANCING DEVELOPMENT.—The Electricity Committee has obtained sanction to a loan of £5,550 for supplying electricity to the Weston Coyney housing estates and £4,669 for a sub-station at Abbey Hulton, and is seeking sanction to borrow £188,000 for mains, services and switchgear. The electrical engineer having submitted a further report with regard to the provision of a 33,000-V supply in the city, it has been decided to lay trunk mains at a cost of £38,000.

PUBLIC SUPPLY FOR CINEMA.—The lessee of the Palace Cinema, Hanley, has agreed to discontinue the existing electricity supply arrangements and take a supply from the Corporation in the event of the Corporation granting him a yearly tenancy of the premises on the expiration of the existing lease in December, 1938. The Estates Committee is willing to grant the tenancy at the present rental, subject to the condition as to electricity supply.

ELECTRIC LIGHTING.—At a recent meeting of the Housing Committee the chief architect submitted an estimate of the cost of wiring the houses belonging to the Corporation at present provided with gas lighting. He was instructed to report as to the order in which it is suggested the sites should be dealt with.

SUPPLY TO COLLIERY CO.—The Electricity Committee has agreed to give a restricted-hour bulk supply to Berry Hill Collieries, Ltd., at the rate of 0.5d. per kWh for the first 500,000 kWh per annum and 0.4d. per kWh for all additional consumption per annum, subject to the usual adjustment for variation in the prices of coal, the demand charges for standby supply to be in accordance with the scale of the Central Electricity Board, plus 10 per cent. The Committee is to seek sanction to borrow £4,700 for the proposed works.

Wakefield.—EXTENSIONS.—Powers are being sought by the Corporation to make further provision in regard to the Corporation's electricity undertaking, including an extension of its area of supply so as to include the whole of the city and a consequential repeal of the powers of the Electrical Distribution of Yorkshire, Ltd., and an amendment of the powers of the Yorkshire Electric Power Co.

Wallasey.—SUB-STATIONS.—The Electricity Committee is to erect sub-stations in Pasture Road at an estimated cost of £7,002 and in Church Lane (£6,592).

Traction

Australia.—MELBOURNE TRAMWAYS.—A table in the annual report of the Melbourne and Metropolitan Tramways Board for the year ended June 30th last gives the double-track mileage of cable tramway as eleven and of electric tramway as 119, in addition to which there was nearly five miles of single-track electric tramway. During the year the conversion of the South Melbourne cable tramway to electric traction was carried out. As traffic conditions did not warrant the conversion of the Port Melbourne cable section to electric traction a bus service was inaugurated. Preliminary survey work was commenced on the conversion of the Bourke Street, Clifton Hill and Nicholson Street cable tramways, and designs prepared for cars of a closed type. An extension of the Essendon tramway was opened for service during the year, and the East Kew tramway was also extended. In January last an Order in Council was obtained for the extension of the Hawthorn Road tramway, and this extension was under construction at the close of the financial year. At the request of the Box Hill Council application was made for an Order in Council to extend the Whitehorse Road tramway, but this had not so far received approval.

London.—" UNDERGROUND " VENTILATION.—The London Passenger Transport Board is to promote a Bill in Parliament authorising it to sink air shafts or construct other works at Oxford Circus station, Mornington Crescent station, Newington Causeway, and Balham High Road, affecting the Northern line, and Lambeth North station, the Bakerloo line, with a view to carrying out schemes to improve ventilation in the tubes. The Board is to spend about £10,000 on experiments with various types of ventilating fans at Oxford Circus.

Leicester.—CHEAPER ELECTRICITY.—The cost of electricity to the Transport Department has been reduced from 0.8d. to 0.69d. per kWh as from October 1st. This will mean a saving to the department of £3,720 a year.

New Zealand.—WELLINGTON TRANSPORT.—The general manager (Mr. M. Cable) reports that during 1936-37 the trams carried 42,886,693 and motor-buses 1,130,844 passengers, against 40,882,010 and 992,791, respectively, in the previous year. Tram miles run numbered 4,159,326 and bus miles 280,686. Receipts per tram mile averaged 22.23d. and per bus mile 14.35d., with

I.M.E.A. Policy

THE I.M.E.A. has just published a pamphlet (16 pages) entitled "Public Authorities and the Development of Electric Supply," in which the part played by public authorities in the growth of the industry " with particular reference to the benefit accruing to consumers," is briefly set forth. Birmingham, Liverpool and Manchester undertakings receive special mention, but municipal enterprise and activities as a whole are covered in the general statement and financial particulars quoted.

The statement concludes with a reference to the " White Paper " on reorganisation and to the I.M.E.A. attitude to the subject generally. The Association, it is stated, has consistently pressed for the retention and extension of public control of electricity supply undertakings and has expressed definite views on the matter to the Minister of Transport, the following being the main principles:—

(i) That in any reorganisation of the electricity supply industry the principle of public ownership and public control shall be maintained and extended.

(ii) That under no circumstances shall a local authority be absorbed by a company.

(iii) That in any acquisition or transfer of an electricity undertaking which may take place, the financial terms must be on an equal basis whether for company or municipal undertakings.

(iv) That as by the sound financial policy followed by municipal undertakings generally, in respect of redemption of loan debt and provision of assets out of revenue, such undertakings have assured for their consumers steadily falling charges in the future, any scheme of compulsory amalgamation must attach full weight to this situation.

(v) That any assumption that small undertakings are necessarily inefficient is unwarranted.

In conclusion, it is contended that under public control the consumer has been, and will continue to be well served; attractive tariffs and services have been introduced, all of which are reflected in the enormous expansion in the electricity supply industry.

working expenses of 17.50d. and 18.04d. Rolling stock at the end of the year consisted of 196 tramcars and 33 motor-buses. Although there was a substantial increase in revenue a greater increase in working expenses resulted in there being a net deficit of £1,550 against a surplus of £793 last year.

Poland.—ELECTRIC TRACTION PREFERRED.—Under the heading "We Prefer Electricity to Steam," the *Express Poranny* (Warsaw) publishes the following note on the increase of passenger traffic which has followed the electrification of the Warsaw suburban railways, in connection with which a £2,000,000 contract, placed jointly with the English Electric Co., Ltd., and Metropolitan-Vickers Electrical Co., Ltd., is now nearly completed: "The Polish State Railways statistics show that the passenger traffic on the electrified suburban lines has considerably grown. Since the electric trains have been put into service the frequency on the Zyrardow line has increased 25 per cent. above the average figure and on the Otwock line 100 per cent. The results are above all expectations, the Polish State Railways management having expected the passenger traffic to rise 15 per cent. above the average figure. This proves that the inhabitants of Warsaw have realised the advantages of the new means of locomotion, compared with steam traffic. The development of Warsaw suburbs is largely due to the electrification of the Warsaw Railway Junction. It is to be expected that in the course of the next ten years close connection of the suburbs of Warsaw to the capital will make them an extension of the city itself in the same way as the suburbs have become around Berlin."

Sunderland.—PURCHASE OF TRAMS.—The Town Council is to improve its tram service by the purchase of eight tramcars from Huddersfield Corporation and six from the London Passenger Transport Board.

Communications

Great Britain.—TELEVISION.—Transmission tests with the B.B.C. mobile television unit are being carried out at Epsom during this month to gauge the possibilities of televising next year's Derby race. The unit will then proceed to Croydon Airport, not only for tests in televising aeroplanes, but in securing interviews with persons arriving and departing. The next testing ground will be Twickenham, where the possibility of televising an international Rugby match will be investigated. The unit will then go down-river to Chiswick, where omnibus driving tests in the London Passenger Transport Board's driving school may yield material for the television screen. The mobile television unit will conclude its December tests at the Ibis Boat Club, Mortlake, to discover whether good pictures can be televised from this portion of the river to justify televising next year's Boat Race.

HULL TELEPHONE UNDERTAKING AND N.D.C.—The position of the telephone undertaking in regard to National Defence Contribution was reported upon by the city treasurer at a recent meeting of the Telephone Committee. He said that electricity, gas, transport and water undertakings were free from N.D.C., but he was afraid that the telephone undertaking was not. That would mean, as near as he could estimate it, that £1,400 would be required from them this year. He was taking the matter up with the Inland Revenue Commissioners to see if there were any means by which exemption could be secured, but as theirs was the only telephone undertaking not under the national system he did not think that the Commissioners would not make an exception.

RADIO RELAYS.—At September 30th, 1937, there were 247,712 subscribers to 331 relay stations in this country, and the percentage of relay listeners to total licences was 2.96. At September 30th, 1936, there were 235,691 subscribers to 347 stations, and the percentage of relay listeners to total licences was 3.02. The decrease in the number of stations is partly due to amalgamation. Broadway Exchange, Ltd., have obtained permission from Wandsworth Borough Council to develop their relay service on the Furzedown housing estate, subject to the payment of one shilling per bracket. At Neath, South Wales, twenty-three schools have become subscribers to the local radio relay service. It has been held in the Skipton County Court that a radio relay service must not be operated from a domestic electricity meter, but from a meter for industrial purposes.

Switzerland. — UNDERGROUND TELEPHONE CABLES. — The *Journal des Télécommunications* reports that good progress is being made with the work of placing telephone lines underground. In addition to the two main lines of communication—those between St. Gall and Geneva and between Basle and Chiasso, on the Italian frontier—operations are now in hand in connection with many of the secondary lines.

The Bell Memorial

AN inscription engraved in a block of sandstone to the left of the doorway of No. 16, South Charlotte Street, Edinburgh, was unveiled on November 24th by Sir George Lee, President of the Institution of Electrical Engineers and Engineer-in-Chief of the G.P.O. The wording on the tablet, which had been erected by the Institution, is:

Alexander Graham Bell,
Inventor of the Telephone,
Born here, 3rd March, 1847.

Mr. E. Seddon (city electrical engineer, Edinburgh), who initiated the scheme, presided over the proceedings, for broadcasting which the B.B.C. had installed duplicate microphones.

The work on voice production carried out by Bell's father, Sir George said, provided a stimulus to Graham Bell in his deliberate efforts to invent the telephone in which he was without the guidance of theory. As young Bell was consumptive, the family moved to Canada, from which he returned to Edinburgh in 1920 to receive the freedom of the city.

At a luncheon given in the Charlotte Rooms by Lt.-Col. F. N. Westbury, Scottish Regional Director to the Post Office, Professor G. W. O. Howe, after a reference to the great scientific laboratory in America that bore Bell's name, justified the claim of Bell to be regarded as the inventor of the telephone. The underlying principles of his system were entirely different from those adopted by Reis, who had developed a make-and-break device that was incapable of transmitting intelligible speech; whereas Bell's invention produced a "sound-shaped" current, termed by Lord Kelvin "a great and happy conception." Bell was not a trained physicist or telegraph engineer, but he was a specialist in the science of speech and acoustics, whose enthusiasm prevented his being warned off the unlikely and apparently hopeless problem.

Mr. F. Gill said that Bell was the first to speak of a telephone exchange. At the present time any subscriber could speak with any one of 39 million (out of a total of 41 million) stations and there were now 150 million calls per day. Dr. L. F. Morehouse, representing the Bell System of the United States—the American Telegraph and Telephone Co.—paid a tribute to Bell's work in that country, and read a letter in similar vein from Mr. W. S. Gifford, the president of his company.

Mr. J. E. Kingsbury recounted his experience of hearing a voice transmitted across a street in 1878, and mentioned the decision of the U.S. Courts that Bell was the first to visualise and bring into operation the transmission of aerial vibrations electrically by wire. After the historical development of telephony up to radio-broadcasting and the 300 simultaneous conversations possible over a pair of wires had been traced by Mr. F. G. C. Baldwin (chief regional engineer, Leeds), Mr. J. J. McKichan (chief regional engineer, Scotland) used a model of Bell's first telephone with amplification as a transmitter in addressing the meeting and then as a receiver. Articulation was better in the first instance. A message from twenty-two members of the Bell family living in the United States was read by Sir George Lee, and a vote of thanks to Col. Westbury was proposed by Bailie E. Walker.

The gathering at the unveiling of the memorial to Alexander Graham Bell at Edinburgh. The tablet is seen in the wall on the left

Contract Information

Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses

Contracts Open

Aberystwyth.—December 21st. Electricity Department. E.h.v. and l.v. underground cables, distribution pillars and disconnecting boxes. (November 26th.)

Ashford (KENT).—December 6th. U.D.C. Electricity Department. Kiosk and one 100-kVA transformer. (November 26th.)

Australia.—MELBOURNE.—December 21st. State Electricity Commission of Victoria. 22,000-V switchgear and accessories. (T.Y. 28275/37.)*
January 11th. Aerial cable for one year. (T.Y. 28804/37.)*

Bathgate.—Education Committee. Electric lighting installation and heating apparatus at additions and alterations to Fauldhouse Public school. Particulars from E. Blades, director of education, Education Offices, by December 6th.

Bradford.—December 14th. Education Committee. Heating and electrical installations at the new grammar school, Thornton. City architect, Town Hall.

Bridlington.—December 4th. Town Council. 11-kV ring-main switchgear equipment, l.v. a.c. distribution panel and one 300-kVA and one 200-kVA transformers. (November 19th.)

Bristol.—December 29th. Port Authority. 15,000 yd. of e.h.v. cable at the Avonmouth and Royal Edward docks. (See this issue.)

Bromley (KENT).—December 11th. Borough Council. 12-cwt. electric vehicle. (November 26th.)

Cannock.—December 18th. U.D.C. Electricity Department. Twelve months' supply of cables and meters. (See this issue.)

Cudworth (YORKS).—December 8th. Education Committee. Electric lighting at school. G. J. Gibbs, Education Office.

Edinburgh.—December 17th. Commissioners of H.M. Office of Works. Domestic engineering service at new Government Offices, Calton site. Engineer, H.M. Office of Works, 122, George Street (deposit £1 1s.).
December 10th. Corporation. Electric lighting and heating at Craigmillar Castle Road primary school and electric lighting at Stenhouse intermediate school. City architect.
December 4th. Electricity Supply Department. Electric lighting and power in Leith fire station, Junction Place. Engineer's Office, Dewar Place (deposit £1 1s.).

Elland.—December 8th. U.D.C. Various works, including electrical, at forty houses. T. Exley-Fisher, architect and surveyor, Council Offices (deposit £1 1s.).

Erith.—December 7th. U.D.C. Electricity Department. Switchgear, transformers and metering equipment. (November 19th.)

Fife.—December 14th. County Council. Electric lighting at school house, Guardbridge. G. Sandilands, county master of works, Property and Works Department, County Offices, Kirkcaldy (deposit £1 1s.).

Gravesend.—December 13th. Electricity Department. Meter testing apparatus and kiosk and switchgear. (See this issue.)

Heston and Isleworth.—December 16th. Electricity Department. Glass bulb rectifier for the Wellington Road sub-station, Hounslow. (See this issue.)

India.—MADRAS.—December 22nd. Electricity Department. Equipment in connection with the change-over of the Pykara-Coimbatore section of the Pykara hydro-electric development scheme from 66-kV to 110-kV operation. (T. 28193/37.)*

Kent.—December 16th. Committee of Visitors. 120-kW generator and heating and hot-water supply apparatus at the County Mental Hospital, Chartham Down, Canterbury. Particulars from W. H. Robinson, county architect, Maidstone (deposit £5 5s.), by December 4th.

Kinghorn (FIFE).—December 13th. Town Council. Electric lighting at thirty houses. W. Williamson & Hubbard, architects, Kirkcaldy.

Kirkcaldy.—December 13th. Corporation. Electrical work at sixteen houses on the Oswald Road estate. Burgh surveyor.

Lancaster.—Electricity Department. E.h.v. pilot and medium voltage p.i., l.c., s.t.a. cables. (See this issue.)

Leeds.—December 8th. Baths and Property Committee. Heating the contents of Roundhay Park open-air pool by electricity or, alternatively, by gas. J. E. Acfield, city engineer, Civic Hall (deposit £3 3s.).
December 10th. Gas Department. Two 200-kW steam driven electric generating plants. (See this issue.)
December 13th. Waterworks Committee. Electrically driven centrifugal turbine type pump, with a capacity of 700 gal. per min., complete with motor, switchgear, starter, &c. H. Shortreed, waterworks manager, Civic Hall.

Letchworth.—December 13th. U.D.C. Duplicate automatic electrically operated crude sewage pumping units, each to deliver 7,500 gal. per hr. Howard Humphreys & Sons, 17, Victoria Street, London, S.W.1 (deposit £2 2s.).

Liverpool.—December 7th. Corporation. Eighteen 750-kVA transformers for static sub-stations. (November 26th.)

London.—METROPOLITAN WATER BOARD.—December 30th. Three d.c. switchboards at the Hampton pumping station. Chief engineer, Room 235, 173, Rosebery Avenue, E.C.1 (deposit £2 2s. to the comptroller to the Board).
ISLINGTON.—December 28th. Borough Council. Meter testing instruments. (November 26th.)
January 12th. Electrical and engineers' stores for one year. (See this issue.)

Middlesex.—December 13th. County Council. Installation of electric lighting and power, &c., at the Redhill County Hospital, Edgware. (November 19th.)
December 16th. Electrical installation at the new senior elementary school, Wilmer Way, Southgate. (November 19th.)
December 23rd. Electrical installation at the elementary school, Kenmore Park Estate, Kenton. (November 26th.)

Mid-Southern Utility Co.—December 10th. H.v. and l.v. p.i. cables. (November 26th.)

Milford Haven.—December 7th. U.D.C. Electricity Department. D.c. and a.c. meter testing equipment and instruments. (November 26th.)

New Zealand.—WELLINGTON.—February 1st. Seven 1,000-kVA. oil-immersed, self-cooled, single-phase, outdoor type transformers and accessories. (T. 28018/37.)* (T. 28019/37.)* 160 galvanised steel transmission line towers. (T.Y. 28597/37.)*
February 8th. 20,000-kVA transformer banks. (T.Y. 28531/37.)*
January 25th. Post and Telegraph Department. Single conductor cable. (T. 28259/37.)*
February 10th. Galvanised steel wire. (T.Y. 28843/37.)*

Northern Ireland.—BELFAST.—December 13th. Town Council. Electrically operated axial-flow type storm pumps, two to deliver 30,000 gal. per minute and two 20,000 gal. per minute of unscreened sewage; one auxiliary sump drainage pump, switchgear, overhead travelling crane, and associated works. City Surveyor's Department, Drainage Section (Room 90), City Hall (deposit £1 1s.).
December 10th. Electricity Committee. Electrically driven centrifugal sewage pump and pipework for the Harbour power station; steel hatchway covers at the Harbour station; and steel and concrete poles for street lighting. (November 26th.)

Ogmore and Garw.—December 16th. U.D.C. Electricity Department. 630 yd. of 11,000-V, 3-phase cable, with l.v. cable to connect up to existing l.v. network, and one 150-kVA oil-cooled transformer, with 11-kV switch fuse isolator. (See this issue.)

Oldham.—December 13th. Electricity Committee. P.i., l.c., l.v. cable and earthenware conduit. (See this issue.)

Portsmouth.—December 14th. Electricity Undertaking. 11-kV overhead line, near Denmead, and one 11-kV pressure regulators at Horndean. (See this issue.)

Rotherham.—December 11th. Transport Department. Four new trolley-bus chassis and bodies. T. P. Sykes, transport manager, Municipal Offices.

Smethwick.—Education Committee. Electric lighting, power, clocks and bells in existing schools. (See this issue.)

South Africa.—DURBAN.—December 10th. City Electrical Engineer's Department. 6,600-V switchgear. (T.Y. 28179/37.)*
PRETORIA.—December 23rd. Public Works Department. One 150-kVA, three-phase transformer, one h.v. and one l.v. switch and underground cable. (T.Y. 28446/37.)* L.v. switches and transformer. (T.Y. 28447/37.)*
December 30th. One 50-kVA transformer, with h.v. and l.v. switches. (T.Y. 28691/37.)*
January 6th. Twenty-eight electric clocks. (T.Y. 28928/37.)*
December 23rd. Union Tenders and Supplies Board. Power equipment for the Bloemfontein carrier repeater station. (T. 28451/37.)*
RICHMOND (CAPE PROVINCE).—January 10th. Municipality. Plant, equipment and materials for power station and distribution network. (T.Y. 28556/37.)*

Southport.—December 13th. Town Council. Water heating installation and electric lighting, power, telephones, clocks and special fire station equipment, &c. (November 26th.)

Wolverhampton.—January 1st. Corporation Water Undertaking. Electrically driven pumping plant, comprising duplicated river, well and forcing sets of 13-, 75- and 337-w.h.p. each, and driven by variable-speed l.v. and h.v. a.c. motors, together with transformers, switchgear, cranes, &c., for the Cosford waterworks reconstruction. Water engineer and manager, Town Hall (deposit £2).

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* Further particulars from the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, London, S.W.1.

Contracts Closed

Birmingham.—Education Committee. Accepted. Electric lighting installation at the new Council school, Stanville Road, Sheldon (£446).—H. Pratt, Ltd. (In lieu of withdrawn tender.)

Blackpool.—Accepted. Electrical work at the new Technical College.—G. B. Moore; Ramsden Bros. (Blackpool).

Glasgow.—Police Committee. Accepted. Secondary lighting in the lecture hall, Recruits' Training Centre (£198).—J. Stuart, Denholm.

Grimsby.—Electricity Committee. Recommended. Cables for twelve months (£10,234).—Johnson & Phillips.

London.—L.C.C.—Accepted. Electric lighting at Commercial Institute, Balham (£865).—Barlow Bros. Co.
Mental Hospitals Committee. Wiring and fittings for electric lighting, power, clocks, telephones, fire alarms and bell

systems, for the second section of the modernisation of Darenth Park:

	£		£
Read and Partners. Accepted...	**6,296**	Electrical Installations, Ltd. ...	7,823
Malcolm and Allan (London) ...	6,387	Berkeley Electrical Engineering Co.	7,920
Buchanan and Curwen	6,402	T. Clarke & Co.	8,011
Archibald Meckbonik	6,975	W. J. Furse & Co. (London) ...	8,100
Atozed (London), Ltd.	7,090	H. J. Cash & Co.	8,130
Pinching and Walton	7,498		
City Electrical Co.	7,743		

LEWISHAM.—Housing Committee. Electrical installations at fourteen flats in Sydenham Road:

	£		£
Payne Bros. Recommended ...	**216**	F. D'Alquen	261
Kirkdale Electrical Co.	218	J. H. Plant, Ltd.	262
Unilectric, Ltd.	221	G. E. Taylor & Co.	278
Pinching and Walton	228	South Metropolitan Electric Light and Power Co.	301
A. J. Hewens & Sons	237		

POPLAR.—Contracts Committee. Recommended. Electric tower wagon (£476).—Corporation Electric Transport, Ltd.

ST. PANCRAS.—Contracts and Stores Committee. Recommended. H.v. switchgear at the Camden High Street substation (£1,535).—A. Reyrolle & Co.

Manchester.—Electricity Committee. Accepted. 400-V substation switchgear for twelve months.—Parmiter, Hope & Sugden; Bertram Thomas. Street lighting poles for twelve months.—Bromford Tube Co. H.p. steam and feed-water valves.—Dewrance & Co.; J. Blakeborough & Sons.

Waterworks Committee. Accepted. Electrically driven pumps.—Mather & Platt.

Sheffield.—Electricity Committee. Accepted. 500 tons of copper wire (£49 per ton).—W. T. Glover & Co.

Stoke-on-Trent.—Housing Committee. Accepted. Electrical installations at sixty-four houses at Cornhill estate (£420).—E. Holloway. Installations at seventy-eight houses on the Hanford estate (£514).—Edstan Electric.

Electricity Committee. Accepted. Electric tower wagon (£483).—Partridge, Wilson & Co. Two 15,000-kVA transformers (£12,800).—Met. Vick. Elecl. Co.

West Lothian.—County Council. Accepted. Electric lighting at fifty houses at Newtown and eighty houses at East Whitburn.—Greig Bros.

Forthcoming Events

Institution of Electrical Engineers.—Monday, December 6th. Institution, London, W.C.2. 7 p.m. Informal meeting. Discussion on "The Human Challenge to Technical and Industrial Changes." To be opened by Mr. L. W. Phillips.

Mersey and North Wales (Liverpool) Centre.—Monday, December 6th. The University, Liverpool. 7 p.m. "Modern Systems of Multi-Channel Telephony on Cables." Col. A. S. Angwin and Mr. R. A. Mack.

North Eastern Centre.—Monday, December 6th. Rendezvous Café, Newcastle-on-Tyne. 7 p.m. Informal meeting in conjunction with the Students' Section. "Question and Answer."

North Midland Centre.—Tuesday, December 7th. Hotel Metropole, Leeds. 7 p.m. "The Examination and Recording of the Human Electro-Cardiogram by Means of the Cathode-Ray Oscillograph." Dr. D. Robertson.

Hampshire Sub-Centre.—Wednesday, December 8th. Municipal College, Portsmouth. 7.30 p.m. "Modern Receiving Valves: Design and Manufacture." Messrs. M. Benjamin, C. W. Cosgrove, and G. W. Warren.

Transmission Section.—Wednesday, December 8th. Visit to the works of Steatite and Porcelain Products, Ltd., Stourport.

Dundee Sub-Centre.—Thursday, December 9th. University College, Dundee. 7.30 p.m. "Layout and Rupturing Capacity of Protective Devices in Motor Circuits." Mr. J. O. Knowles.

Meter and Instrument Section.—Friday, December 10th. Institution, London, W.C.2. 7 p.m. "Organisation of a Meter Test Department of a Large Supply Undertaking, with Special Reference to the Meters Act, 1936." Mr. C. W. Hughes.

Illuminating Engineering Society (*Irish Free State Centre*). Tuesday, December 7th. 35, Dawson Street, Dublin. 8 p.m. "Glassware in Relation to Illuminating Engineering." Dr. S. English.

Scottish Centre.—Wednesday, December 8th. 19, Gordon Street, Glasgow. 7.30 p.m. "Electric Lamps, Their Specification and Testing." Mr. T. M. Lappin.

Decorative Lighting Section.—Friday, December 10th. Institution of Mechanical Engineers, London, S.W.1. 6.30 p.m. Discussion on Problems in Decorative Lighting.

British Institute of Radiology (*Röntgen Society*).—Wednesday, December 8th, to Friday, December 10th. Central Hall, Westminster, London, S.W.1. Annual congress and exhibition of X-ray apparatus. Friday, December 10th. Piccadilly Hotel, London, W.1. 7.30 for 8 p.m. Annual dinner.

Diesel Engine Users Association.—Wednesday, December 8th. Caxton Hall, London, S.W.1. 4.45 for 5 p.m. "Diesel Influence on Road Transport Costs." Major P. M. Sanders and Mr. E. K. Wenlock.

Electrical Power Engineers' Association (*Northern Division*).—Thursday, December 9th. Geographical Hall, Parsonage, Manchester. 7.15 p.m. "Recent Developments in High Rupturing Capacity Switchgear." Mr. W. A. Coates.

Institute of Fuel.—Thursday, December 9th. Junior Institution of Engineers, London, S.W.1. 6 p.m. "Pulverised Fuel Firing."

Junior Institution of Engineers.—Friday, December 10th. Royal Society of Arts, London, W.C.1. 7.30 p.m. Inaugural meeting. Presidential address by Mr. W. A. Tookey. "A Half Century of Engineering Progress."

"Old N'Ions" (*Northampton Engineering College Past Students' Association*).—Friday, December 10th. Café Royal, London, W.1. 7.30 for 8 p.m. Annual dinner.

Notes

E.A.W. Activities

An excellent send-off was given to the new Thames Valley Branch of the Electrical Association for Women last Friday, when there was an attendance of about a hundred at the inaugural meeting presided over by the chairman, Mrs. A. G. Kemsley. After Miss Caroline Haslett, director of the E.A.W., had described the objects and past achievements of the Association, Mr. J. W. Beauchamp briefly outlined the administrative side of electricity supply in Great Britain and declared that he was looking to the new knowledge which women were obtaining as a result of the Association's activities to remove some of the "snags" and anomalies which were preventing supply undertakings from selling electricity as cheaply as they might wish. The lowering of prices depended on the increasing use of electricity by consumers. Support to the formation of the new branch was also given by Mr. F. W. Purse, chief engineer of the London and Home Counties Joint Electricity Authority, and Mr. E. J. Jarvis, borough electrical engineer of Kingston-upon-Thames. The secretary of the new branch is Mrs. F. Byrne, 172, Elmbridge Avenue, Surbiton.

The Croydon and District Branch held its annual dinner at Shirley Park Hotel on November 24th, Mrs. F. N. Rendell-Baker, chairman of the Branch, presiding. The guests included Miss Haslett, Sir Montague Hughman, Mrs. Pender-Chalmers (vice-chairman of the Association), Councillor A. Lester Boddington, chairman of the Electricity Committee; Mr. F. N. Rendell-Baker, borough electrical engineer, and Alderman Bessie Roberts.

An illustrated pamphlet, entitled "Contribution to Progress," giving a brief outline of the many ramifications of the Association's work, is now available (price 3d.) from the E.A.W. headquarters, 20, Regent Street, W.1.

Copper and Copper Alloys

A high conductivity copper, substantially free from oxygen and intended for use where the maximum ductility, toughness, resistance to fatigue and immunity from embrittlement when annealed in hydrogen are required, is now being produced by British Insulated Cables, Ltd., under the name of "Bicop" brand copper. Two copper alloys have been developed by the same company under the names of "Presmet" and "Presap." The distinctive attributes of the first are that it retains its hardness at elevated temperatures and it can be rendered soft or exceptionally hard by heat treatment. It is claimed to have excellent properties in contact blocks of resistance welders. Spring clips made from it, heat treated after the final shaping operation, are reported to have retained their elasticity after repeated opening and shutting. The "Presap" alloy is manufactured in the form of rods and is designed for the welding of bonds to steel rails, the welds being free from oxide or porosity, or for use in any kind of copper welding requiring the use of a "filler" rod.

Birmingham Technical College

The Technical Education Sub-Committee of the Birmingham Education Committee last week presented a report on the work achieved during the past year in which it states that the work of the Department of Electrical Engineering is developing steadily on the light current side. The new course started two sessions ago in radio service work is meeting a real need and has now been extended to cover the City and Guilds examination. Towards the end of the session work was started on the first floor of the Broad Street extension, converting it into laboratories for telecommunications and radio work. A national certificate course in telecommunications was planned, and approval has now been granted.

Paisley Engineers

At a recent meeting of the Paisley Association of Engineers three short papers were submitted. Mr. A. Richardson talked about the I.E.E. Regulations, stressing the desirability of installing good accessories and ensuring first-class workmanship. Mr. H. Heyes recounted some experiences on the road and discussed the qualifications needed by travelling agents. Mr. W. Wilson outlined the Electricity Supply (Meters) Act, 1936, and its possible effects.

School of Engineering and Navigation

The annual dinner of the School of Engineering and Navigation Old Boys' Society will be held on December 11th at Cannon Street Station Restaurant, when Messrs. E. S. Byng (Standard Telephone & Cables, Ltd.) and J. Butt and H. J. Vose (School Advisory Sub-Committee) will be guests.

Appointments Vacant

Electrical inspector for Surrey County Council.

Part-time electrical engineer for Ruthin Electricity Department.

Chief clerk for Salford Electricity Department.

Two junior mains assistants for Ayrshire Electricity Board.

Showroom assistant and general clerk for Gillingham Electricity Department.

Consumers' assistant for Milford Haven Electricity Department.

(See our Classified Advertisements.)

Our Personal Column

Electrical men are invited to keep readers of the "Electrical Review" posted concerning their movements

Mr. J. E. Shepherd, borough electrical engineer at Rawtenstall, who has been recommended for the appointment of borough electrical engineer of Barrow, was apprenticed to Whipp & Bourne, switchgear manufacturers and contractors, of Rochdale. As a youth he joined the Rawtenstall Corporation Electricity Department as an electrical assistant. After returning from service in the Air Force in 1919 he was appointed mains superintendent, and in 1931 he was appointed borough electrical engineer. Mr. Shepherd was recently appointed borough electrical engineer at Ashton-under-Lyne, but that Council permitted him to appear at Barrow for interview as he had applied for the Barrow position before that of Ashton-under-Lyne. The Rawtenstall Corporation owns a selected station, which is operated by the Central Electricity Board. The Corporation supply in bulk to the two neighbouring boroughs of Bacup and Haslingden, and, in addition to its own area, the supply extends into the Burnley rural area. Mr. Shepherd has served on E.D.A. Committees for the last six years and has been a member of the Textile Tariff Committee and of the Engineering Advisory Committee for the Mid-Lancashire Advisory Board.

Mr. J. E. Shepherd

Mr. J. Hatton, assistant transport manager of the Stalybridge, Hyde, Mossley and Dukinfield Joint Transport and Electricity Board, retired under the superannuation scheme on November 30th after thirty-four years' service.

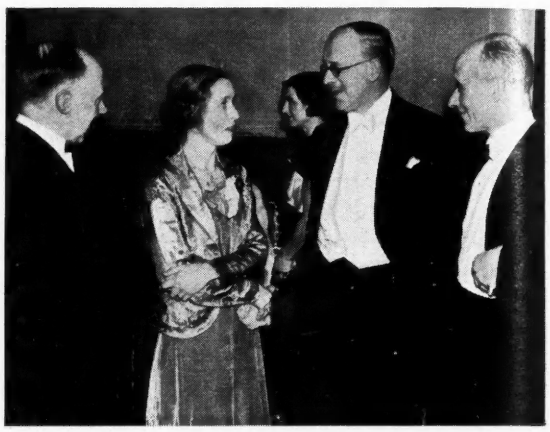
Mr. H. E. Annett, borough electrical engineer, Bolton, has been appointed by the Central Electricity Board as a member of the Consultative Technical Committee for the North-West Area.

Mr. E. Thorpe, of Watford, has been appointed control engineer, and **Mr. J. M. Beskine,** of Battersea, relief control engineer, to the Croydon Corporation Electricity Department.

Mr. T. V. Dixon has been appointed a director of Brown Brothers (Ireland), Ltd. Mr. Dixon joined that company shortly after the war. In 1928 he was appointed manager of the Belfast branch, and after seven years' service returned to Dublin to take up the position of joint manager with Mr. A. C. Taylor. **Mr. B. V. Holbrook** has been appointed manager of the Hull branch in succession to Mr. D. R. Blake. Mr. Holbrook has for some years been assistant manager at the Leeds branch, having served with the company since 1920. **Mr. F. Mitchell,** a representative of the company in Yorkshire for many years, has been appointed assistant manager of the Leeds branch.

Mr. T. H. Watson, Grad.I.E.E., has resigned his post as chief meter tester with the Norwich Corporation Electricity Department, to take up the appointment of meter engineer with the Electricity Department of the Kettering Urban District Council. Mr. Watson enters upon his new duties on January 1st. He was formerly with Chamberlain & Hookham, Ltd.

Mr. E. Ridley, M.B.E., M.I.E.E., principal technical assistant (special services) in the Architects' Department of the L.C.C., is retiring in January next. Mr. Ridley entered the service of the Council in 1906 as an electrical and mechanical engineer in the Fire Brigade Department. In 1911 he was promoted to the rank of principal assistant and later to the position of engineer-in-charge (inspection). He was responsible for advising the chief officer of the London Fire Brigade on all engineering questions at places of public entertainment, for the annual inspection of all such buildings, and for the special duties referred by the Entertainments Committee to the chief officer in connection with such premises. In 1933, in consequence of the Council's decision to place the major part of such work under the direction of the architect, he became the principal technical assistant (special services). He was awarded the M.B.E. for his services as hon. secretary of the Minister of Munitions Fire Protection Committee during the war. Mr. Ridley has for many years served on the Standing Committee of the I.E.E. responsible for the drawing-up of the "Regulations for the Electrical Equipment of Buildings."



Mr. G. Leslie Wates (chairman of Johnson & Phillips, Ltd.), Mr. C. Stewart and Mr. and Mrs. P. V. Brittlebank at the J. & P. London office dance held at Victoria Hall on November 26th

On leaving the staff of British National Electrics, Ltd., Newarthill, to take up an appointment as chief electrical draughtsman with Carron Company, Falkirk, **Mr. Logan Taylor** has been presented with a gold hunter watch by his colleagues. He had been on the staff of the company since its inception five years ago.

Mr. J. Houston, mechanical superintendent in the Kirkcaldy Corporation Electricity Department, has retired from that position after thirty-five years' service, and on November 26th Mr. O. F. Francis, the chief electrical engineer, presented him with two easy chairs on behalf of the employés of the Department.

Mr. W. R. Hall has been appointed managing director of Ismay Cables, Ltd., in the place of Mr. W. L. Moggeridge, whose death is recorded on the next page. He has been associated with the company since its inception, and prior to this was connected with Derby Cables.

At Last Week's E.I.B.A. Ball

Left to right: Mr. H. Marryat and Mrs. Murray Scott; Mrs. P. Leese and Mr. H. M. Drake; the Hon. Mrs. Leslie Gamage and Mr. F. Parkinson (president of E.I.B.A.)

Obituary

Mr. W. J. Moggridge.—We regret to announce the death on November 20th, after a short illness, of Mr. W. J. Moggridge, managing director of Ismay Cables, Ltd.

Mr. D. Grant.—A *Reuter* message from Lisbon reports the death, at the age of forty-eight, of Mr. Douglas Grant, a native of Manchester, who was a director in Portugal of the Anglo-Portuguese Telephone Co. Mr. Grant had been associated with the company since his arrival in Lisbon in 1913.

Mr. B. A. Martin Cooper.—We regret to learn of the death of Mr. B. A. Martin Cooper, H.M. Electrical Inspector of Factories (Leeds Area), which occurred on November 25th at the age of forty-nine. Before joining the Factory Department of the Home Office Mr. Martin Cooper was chief assistant with the Worcester Corporation Electricity Department.

Mr. R. Simpson.—The death has occurred at Whitley Bay of Mr. Robert Simpson, who was manager for a time of the Tynemouth and District Electric Traction Co., Ltd., under the British Electric Traction Co., Ltd., and afterwards occupied a similar post with the latter company in the south. He retired some time ago.

Mr. H. Morton, aged sixty-one, electrical engineer to the Llandudno Urban District Council, died in Llandudno Hospital on November 24th. Mr. Morton had been the electrical engineer to the Council for more than forty years.

Telephone men will learn with regret that the death occurred in London on November 26th, at the age of 70 years, of the widow of **Mr. Herbert Lawes Webb.**

Will.—Mr. W. Tangye, late chairman and managing director of Tangye's, Ltd., left £118,941, with net personalty £106,207.

Financial Section

New Companies. Official Returns of Capital. Debenture Charges. Reports of Electrical Companies. Dividend Announcements. Transactions in Stocks and Shares

New Companies Registered

Savage & Parsons, Ltd.—Private company. Registered November 19th. Nominal capital, £90,000. Objects: To adopt agreements with (*a*) J. C. Savage, British Instrument Company, Ltd., Société Internationale pour la Reclame Aerienne, and C. A. Parsons & Co., Ltd., and (*b*) A. Reyrolle & Co., Ltd., and C. A. Parsons & Co., Ltd., and to carry on the business of manufacturers and operators of and dealers in searchlights and projection apparatus of all kinds, sound locators and detectors, optical, acoustical, aeronautical, electrical, mechanical and general engineers, founders, manufacturers of and dealers in implement and machinery of all kinds, shipbuilders, &c. The first directors are: J. C. Savage, L. W. Croft, G. A. Lingham, F. G. H. Bedford and G. Wansbrough. Registered office: London Aerodrome, Hendon, N.W.9.

Reliable Radio, Ltd.—Private company. Registered November 24th. Capital, £100. Objects: To carry on the business of manufacturers of and dealers in radio apparatus and machines, &c. The life directors are: T. H. Stedman, senr., 125, Brookmill Road, S.E.8; and G. W. Hare, 140, Creek Road, S.E.8. Secretary: T. H. Stedman, jnr.

Richard's Radio, Ltd.—Private company. Registered November 22nd. Capital, £100. Objects: To carry on business as manufacturers of and dealers in gramophones, sound reproducing machines, &c. The subscribers are: R. S. Porte, 92, Berkeley Avenue, Cranford, Middlesex; and T. O'Sullivan, 20, Hanover Square, W.1. R. S. Porte is first director. Registered office: 13, Berkeley Parade, Cranford, Middlesex.

Test Gear Development, Ltd.—Private company. Registered November 24th. Capital, £1,000. Objects: To carry on the business of manufacturers, assemblers, importers and exporters of and dealers in test gear of all types, and all other kinds of radio and electrical apparatus, &c. The subscribers are: J. V. Sims, 67, Pinglestone Close, Harmondsworth, Mdx.; and G. R. Williams, 32, Wingate Road, Hammersmith, W.6. J. V. Sims is the first director.

Raymill, Ltd.—Private company. Registered November 24th. Capital, £5,000. Objects: To carry on the business of screw manufacturers, capstan and general machinists, small metal ware manufacturers, manufacturers of and dealers in nuts, bolts, all kinds of electrical equipment, &c. The directors are: G. A. Mills, R. A. W. Mills and M. E. Mills, all of "Wolverley," 15, Shenstone Avenue, Quinton, Birmingham. Secretary: M. E. Mills.

Atozed (London), Ltd. — Private company. Registered November 22nd. Capital, £5,000. Objects: To carry on business as electric sign and lighting specialists, &c. The directors are: J. A. Gould (permanent), Hampton Court Road, Hampton Wick (director of Atozed (Kingston), Ltd.; and J. Stock, "Charem," Beverley Road, Worcester Park, Surrey. Registered office: 176, Vauxhall Bridge Road, S.W.1.

Excelier Manufacturing Co., Ltd.—Private company. Registered November 24th. Capital, £500. Objects: To carry on the business of electrical and mechanical engineers, manufacturers of and dealers in all kinds of forgings, castings, equipment and accessories of metal construction, &c. The subscribers are: R. S. Hancock, 106, Grenville House, Dolphin Square, Grosvenor Road, S.W.1; and E. Weatherall, Excel House, Whitcomb Street, W.C.2. Registered office: Lancaster Works, Legge Lane, Birmingham.

Allied Car Electrics, Ltd.—Private company. Registered November 25th. Capital, £1,000. Objects: To carry on the business of dealers in and manufacturers of batteries, accumulators or other electrical apparatus, &c. The directors are: S. Threadgold, 189, Holly Hedge Road, Benchill, near Manchester; and H. F. Bescoby, 875, Oldham Road, Thornham, Rochdale.

Herman Electric, Ltd.—Private company. Registered November 25th. Capital, £2,000. Objects: To carry on the business of manufacturers of, agents for, and dealers in, electric lamps and electrical accessories and apparatus, electric glassware and fittings, radio, &c. The subscribers are: M. A. Tarlo, 119/120, London Wall, E.C.; and A. R. Rosenberg, 119/120, London Wall, E.C. Solicitors: Tarlo & Co., 119/120, London Wall, E.C.

Gray's (Manchester), Ltd.—Private company. Registered November 26th. Capital, £1,000. Objects: To acquire the business of radio and electrical contractor and cycle dealer carried on by R. E. Gray. The permanent directors are: Mrs. R. E. Gray and C. H. Gray, both of 154, Shrewsbury Street, Manchester, 16. Registered office: 144, Shrewsbury Street, Manchester.

Lawes Radio & Electrical Company, Ltd.—Private company. Registered November 27th. Capital, £2,000. Objects: To acquire the business of a general and consulting radio and electrical engineer carried on by R. C. Lawes, at 9, Guinea Street, Exeter. The directors are: R. C. Lawes, 9, Guinea Street, Exeter, D'Arcy Drake, 36, Holland Road, Exeter, and W. W. Smith, address not stated. Secretary: W. W. Smith.

Lowestoft Electrical Co., Ltd.—Private company. Registered November 26th. Capital, £1,000. Objects: To acquire the business of an electrical engineer and contractor carried on by K. I. Rayment as Lowestoft Electrical Co. The subscribers are: K. Rayment and Mrs. S. Rayment, of 32, Regent Road, Lowestoft. K. I. Rayment is permanent managing director so long as he holds 200 shares.

Knuelastic Electric Cable Co., Ltd.—Private company. Registered November 26th. Capital, £10,000. Objects: To acquire any patents, licences and the like rights, and in particular (*inter alia*) the benefit of the letters patent referred to in an agreement with Henry M. Fisher, and to carry on the business of manufacturers of and dealers in all kinds of machinery, electric motors, electrical apparatus and accessories, electric cables, coils, &c. The subscribers are: H. W. Brown, 72, Felstead Road, Orpington, Kent, and C. J. Knight, 170, Lower Road, S.E.16. Registered office: 6, Arlington Street, St. James's, S.W.1.

Aurora Signs, Ltd.—Private company. Registered November 27th. Capital, £300. Objects: To carry on the business of manufacturers and repairers of and dealers in neon advertising and lighting signs, &c. The directors are: C. Kinloch, 41, Hawke Road, S.E.19, J. S. Ewart, Cranmore Park, Yarmouth, I.W., and M. C. Low, 41, Hawke Road, S.E.19. Registered office: 13, Station Avenue, Loughborough Junction, S.W.19.

Uni-Relays, Ltd.—Private company. Registered November 22nd. Capital, £500. Objects: To construct and maintain wireless signal stations and all other stations, &c. The directors are: F. Nuttall, "Oakdene," Rawtenstall (director of Haslingden Radio Relay Co., Ltd.), and seven others.

Temple Electrical Co., Ltd.—Private company. Registered November 13th. Capital, £100. Objects: To carry on the business of electrical engineers and consultants, electrical contractors, manufacturers of and dealers in all kinds of electrical apparatus, &c. The permanent directors are: C. J. Pell, Yarburgh House, Fitzalan Road, Finchley, N.3; and H. Clayton, Dorset House, Upper Gloucester Place, N.W.1. Registered office: Australia House, Strand, W.C.2.

Eca-Ray Manufacturing Co., Ltd.—Private company. Registered November 19th. Capital, £100. Objects: To carry on the business of producers and manufacturers of and dealers in reflectors of all kinds, luminous signs and decorative lighting vessels, cinema, photographic, radio and acoustical apparatus, television apparatus, electric discharge vessels, &c. The permanent directors are: H. F. Tilsley, 20, Lovelace Road, Surbiton; E. Langrish, 25, Denmark Road, Carshalton, Surrey, and E. C. Ferguson, Tefrellin, Oakleigh Avenue, N.20. Registered office: 12a, Bourchier Street, Wardour Street, W.1.

Reflexon (London), Ltd.—Private company. Registered November 13th. Capital, £100. Objects: To carry on the business of manufacturers and repairers of and dealers in electrical and radio apparatus, appliances and equipment, general engineering specialities and supplies, &c. The directors are: C. Terrell, address not stated, and R. H. Webb, 28, Gilbert Road, Kennington, S.E.11.

Scottish Radio Co. (Glasgow), Ltd.—Private company. Registered in Edinburgh November 11th. Capital, £100. Objects: To carry on the business of manufacturers, importers and exporters of electrical and other instruments, appliances and materials, &c. The subscribers are: W. Keir, 20, Pollock Road, Bearsden, Dumbartonshire; and J. C. Williamson, 3, Naseby Avenue, Glasgow, W. W. Keir is the first director. Registered office: 395, Argyle Street, Glasgow, C.3.

Returns of Electrical Companies

Thomas Winston, Ltd.—Debenture, charged on the company's undertaking and property, present and future, including uncalled capital, dated November 1st, 1937, to secure £4,500 and further advances. Holders: Bank Hey Street Stores, Ltd., "Lyndale," Park Road, Blackpool.

Electronaire Marketing Co., Ltd.—Debenture, charged on the company's property, present and future, including uncalled capital, dated October 18th, 1937, to secure £120. Holders: A. J. Stanley, 4, Park Lane, W.1.

Metropole Electrical, Ltd.—Mrs. M. Taylor, of 78, Russell Road, Moseley, Birmingham, ceased to act as receiver and manager on October 26th, 1937.

Gainsborough Radio, Ltd.—Debenture charged on the company's undertaking and property, present and future, including uncalled capital, dated October 30th, 1937, to secure £1,000. Holders: Best Properties (Coulsdon), Ltd., 56, Ludgate Hill, E.C.

Pye, Ltd., Ltd.—Capital, £335,200 in £150,000 preferred ordinary stock, £169,000 deferred ordinary stock, and 64,800 deferred ordinary shares of 5s. Return dated June 24th, 1937. All stock taken up. £162,300 paid. £156,700 considered as paid. Mortgages and charges, nil. The deferred ordinary shares were allotted for cash on November 5th, 1937.

Dubilier Condenser Co. (1925), Ltd.—Capital, £500,000 in 500,000 10 per cent. non-cumulative preference shares of 10s. and 5,000,000 ordinary shares of 1s. Return dated June 11th, 1937. 200,000 preference and 1,539,375 ordinary shares taken up. £176,968 15s. paid. Mortgages and charges, nil.

Hornes Radio, Ltd.—Capital, £500 in £1 shares. Return dated June 28th (filed October 1st), 1937. 325 shares taken up. £325 paid. Mortgages and charges, nil.

Padiham Wireless Relay Co., Ltd.—Capital, £1,000 in £1 shares. Return dated July 1st, 1937. 825 shares taken up. £825 paid. Mortgages and charges, nil.

Bowlings Electric Supply, Ltd.—Debenture charged on the company's undertaking and property, present and future, including uncalled capital, dated November 12th, 1937, to secure £300. Holders: E. H. Lane, 10, Carlos Place, Grosvenor Square, W.1, and Thos. P. Bennett, 43, Bloomsbury Square, W.C.1.

John Holder & Co., Ltd.—Particulars filed of £2,000 debentures authorised October 26th, 1937, charged on the company's undertaking and property, present and future, including uncalled capital, the amount of the present issue being £1,000.

Petbow, Ltd.—Debenture charged on the company's undertaking and property, present and future, including uncalled capital, dated November 15th, 1937, to secure all sums due or to become due up to a maximum of £12,000. Holder: Henry P. Bowler, Herons Lodge, Heronsgate, Herts.

Telephone and General Trust, Ltd.—Particulars filed of debenture stock to secure £400,000 and premium of 1 per cent. authorised July 18th, 1937, and covered by trust deed dated November 3rd, 1937, charged on the company's undertaking and property, present and future, including uncalled capital, the amount of the present issue being £200,000. Trustees: Midland Bank Executor & Trustee Company, Ltd.

Transformers & Welders, Ltd.—The nominal capital has been increased by the addition of £30,000 beyond the registered capital of £10,000. The additional capital is divided into 27,000 6 per cent. participating preferred ordinary shares of £1 and 60,000 ordinary shares of 1s.

North Lincolnshire and Howdenshire Electricity Co., Ltd.—The nominal capital has been increased by the addition of £100,000 in £1 ordinary shares beyond the registered capital of £350,000. The Yorkshire Electric Power Co. holds practically all the shares.

United Electrical Co. (Coolex), Ltd.—The nominal capital has been increased by the addition of £15,000 in £1 ordinary shares beyond the registered capital of £5,000.

J. J. Marr & Co., Ltd.—Capital, £500 in £1 shares. Return dated July 7th, 1937. All shares taken up. £500 paid. Mortgages and charges, nil.

Roberne Electrical Supplies Co., Ltd.—Capital, £1,000 in £1 shares. Return dated September 30th, 1937. 530 shares taken up. £50 paid, £2 calls unpaid, £478 considered as paid. Mortgages and charges nil.

Chorley Radio Relay Service, Ltd.—Capital, £2,150 in 2,000 preference shares of £1 and 3,000 ordinary shares of 1s. Return dated October 27th, 1937. All shares taken up. £2,150 paid. Mortgages and charges nil.

Chadwick Electrical Co., Ltd.—Capital, £500 in £1 shares. Return dated August 10th, 1937. 10 shares taken up. £10 paid. Mortgages and charges nil.

Wessex Ignition Co., Ltd.—Capital, £100 in £1 shares. Return dated November 4th, 1937. All shares taken up. £2 paid, £98 considered as paid. Mortgages and charges nil.

City Notes

Electrical Switchgear & Associated Manufacturers, Ltd., held its second annual meeting on November 25th, when Mr. J. A. Hirst (chairman), who presided, said that the income of the company came almost entirely from the operating company, Brookhirst Switchgear, Ltd., but that the interest also received exceeded the administration expenses. With regard to Brookhirst Switchgear, Ltd., new records had been established by the profits for the year ended July 31st, turnover, and number of employés. The extent of the orders in hand at the present time was satisfactory and the state of the order book, together with the increase in output, comprised the best augury for the current financial year. The results of the past twelve months had been achieved under the difficulty of high pressure production proceeding concurrently with extensions to buildings and changes and additions to equipment. Some houses and land adjoining the Chester works had also been acquired and this represented a reserve in case of further expansion being necessary. During the year further increases in workmen's wages had been made and prices of purchased materials had also risen, but selling prices, as far as possible, had been adjusted accordingly. A welfare fund had also been founded.

Crompton Parkinson, Ltd., report a net profit for the year ended September 30th of £403,864, as compared with £353,958 in the preceding year, to which is added £79,232 brought in, making £483,096. It is proposed to place £290,884 to general reserve and to allocate a further £5,000 to the central benevolent fund, making a total of £22,000 transferred to that fund in a period of three years. The final ordinary dividend is 6½ per cent., making 12½ per cent. for the year (same), and £70,546 is carried forward. Similarly to last year it is proposed to capitalise £40,884 of the general reserve to be distributed to holders of ordinary and/or "A" ordinary shares in the form of new "A" ordinary shares of 5s. each fully paid in the proportion of seven new shares for every 100 ordinary and or "A" ordinary shares held. In addition, a special bonus distribution will be made out of capital reserve of one new "A" ordinary share of 5s. fully paid for every three ordinary and/or "A" ordinary shares held. To enable this special bonus issue to be made it is proposed to increase the capital of the company to £1,700,000 by the creation of a further 800,000 "A" ordinary shares of 5s. each.

Mr. F. Parkinson has issued his remarks to shareholders in advance so that the time at the annual meeting (December 10th) can be devoted to dealing with any questions that may arise out of the accounts and reports or the chairman's notes. Mr. Parkinson says that the company has again succeeded in establishing a new high record of profit earning, and this is a reflection of improved trading conditions, still further increased turnover and the overall efficiency of the organisation. During the year practically every component of manufacturing and distributing costs has increased in price, and although it has been necessary to increase the selling price of some of the products, the maintenance of the ratio of profit over turnover is more the reflection of improved technique than of selling price adjustments. The money received from the issue of shares last year has been used to finance capital expenditure, most of which has been incurred in their subsidiary and associated companies. It has also enabled them to finance the increased stocks and outstanding debts that are a natural consequence of their increased output and turnover, and to retain most of their current earnings to strengthen still further the liquid resources of the company. Referring to income tax reserve, Mr. Parkinson says that they have thought it wise to alter the basis of the provision for such reserves so as to provide not only for the taxation actually accrued, which is based on the preceding year's profits, but for the tax liability on the whole of the profits included in the accounts. This alteration has necessitated the provision out of the current earnings of a substantial additional sum.

Dealing with the company's various products, the chairman states that during the year they have incorporated in their range of electrical plant a number of new types of machines specially designed to meet the growing demand for electrical and mechanical characteristics not usually available in "standard" ranges. They are increasing the equipment in their testing station to enable their engineers to design and construct plant and switchgear to meet the future needs of the industry. A record output has been achieved by their subsidiary, the British Electric Transformer Co., Ltd.

Negotiations have been successfully concluded for the settlement of actions instituted against them for alleged infringement of certain lamp patents, as a result of which all expenditure under this heading has ceased. The directors are convinced that past expenditure in the defence of the actions has been justified by the terms of the settlements achieved. During the past year they have increased the range of electric lamps and are now marketing "Crompta" electric-discharge lamps of the mercury-vapour type. Their new factory at Guiseley is nearing completion, and will be available for lamp production early in the coming year. The orders received in the electric traction section have increased considerably, and their works will be fully occupied for many months to come. Their equipment has been selected for the latest "streamlined" trains. Important contracts have been received by their subsidiary, the Atlas Sprinkler Co., Ltd., for fire protection equipment. The new buildings and equipment at Derby for the manufacture of both paper and rubber cables were completed early in the current year and have been in full production throughout the year. The turnover in cables has reached a new high record and the reputation of Crompton cables has been fully maintained in both home and overseas markets.

They have commenced the new financial year with an order book appreciably larger than a year ago. The report of the Central Electricity Board indicates that in 1935-36 about 40 per cent. of the premises in the various areas of supply remained unconnected to the supply systems. This leaves no room for doubt that the electrical manufacturing industry can look forward to a continued demand for new equipment for many years to come. Their interest in overseas business continues to grow from year to year and the period under review has seen a continuance of the expansion of their turnover and the growth of their goodwill in an increasing number of countries abroad. They are taking an active part in an endeavour to secure a closer degree of co-operation between the principal British manufacturers with a view to obtaining for this country a greater proportion of the available overseas business and on more satisfactory terms.

Their superannuation funds are now available, under stated conditions, to all their male and female employés who may thus qualify for retirement at the age of sixty with a pension

equal to half their salary or wage. The provisions thus made are being increasingly appreciated by their employés, and the directors feel that the excellent, loyal service rendered to the company by the staff and workers year by year fully justifies, and indeed commands, their generosity.

The British Electric Transformer Co., Ltd., reports a profit for the year ended September 30th of £79,599, as compared with £52,106 in the preceding year, which with £1,683 brought in makes £31,282 available. The final ordinary dividend is 1s. per share, making 3s. 6d. per share for the year, tax free, and £1,750 is carried forward. The report states that there has been a further considerable increase in the volume of business obtained for transformers. The company has disposed of its interest in the lamp business to an associated company. This transaction has been carried through for rationalisation purposes, and has resulted in the creation of a capital reserve of £100,000, which strengthens still further the position of the shareholders and the liquid resources of the company.

Heenan & Froude, Ltd., held their annual meeting on November 24th, Mr. A. P. Good (chairman) presiding. In presenting the report and accounts the chairman said that they had decided to institute a pension scheme for the staff on retirement at the age of sixty-five. The manufacture of refuse destruction and incineration plants, which was one of their main businesses, involved a substantial amount of work which they did not produce themselves. They had, therefore, obtained the manufacture of a speciality which would balance that position. This already had a turnover of about £70,000 a year, which they thought would increase, as a large proportion of the turnover was in spare parts. The selling company for whom they manufactured had got adequate orders in hand, and since they had been associated with them they had booked an additional large order which would form a backbone to the work from this direction for the next three years. They had secured a foundry immediately opposite their works, on such a basis that the business showed a good return on the money invested. Court Works, Ltd., a subsidiary, had had another satisfactory year. With regard to the future, they had completed important modifications in design to certain classes of their dynamometers and coolers. In the latter it would enable them to be even more competitive in price and efficiency. Every effort had been made to develop foreign sales. They had already over £525,000 of orders in hand, and they expected to beat last year's record output. Only 10 per cent. of their output last year was for the Government, so that the increase in turnover could not be attributed to rearmament demands.

Enfield Rolling Mills, Ltd., held its annual meeting on November 26th when the Earl of Verulam (chairman), who presided, said that a profit of £76,000 had been earned, and while they were still left with a debit balance of over £30,000, if the improvement of 1937 could be maintained in 1938 they might look forward to a position in which a balance on the right side and the possibility of dividends were in sight. At their last meeting the estimates put forward were based on their receiving in March last certain items of plant, the lack of which had been holding up the output of several classes of material. Some of the plant was still not in and was not now expected till next February. Delays of that sort were common experience since the Government rearmament programme had come into being. The change in the management of the copper and brass sheet rolling mill, mentioned last year, had resulted in an improvement in that department. The results of last year in the rod rolling mill had been adversely affected by the necessity to overhaul that mill, which had been running continuously for about ten years. The overhaul was completed and the mill was again working as well as when it was new. The rest of their plant had been improved during the year, and there were still further improvements in hand depending on deliveries by their suppliers. They had shared with others in the general activity of business. In most sections of their work better and larger orders had come in than they had been able to secure in the past.

The Manaos Tramways & Light Co., Ltd., reports a net operating profit for the year ended April 30th of £16,480, as compared with £7,946 in the preceding year, to which is added £605 interest on investments and transfer fees, making £17,085. From this is deducted debenture redemption, London office expenses and directors' fees, totalling £13,594. After charging £12,102 in respect of amortisation, the balance of £1,492 is transferred to debenture interest account, making the total of this account £1,843. Payment of 1 per cent. interest on debentures will be made on December 7th. The company has to face an immediate demand for increased capacity which in present circumstances it is unable to finance, and at the same time much needed and long overdue rehabilitation of property. The directors hope that, as a result of discussions now taking place in Manaos, it will be possible to formulate a scheme of reorganisation that will take care of the future.

British Industrial Plastics, Ltd.—Presiding at the annual meeting held on November 24th Mr. K. M. Chance (chairman and managing director), said that there had been a greatly increased demand for their "Scarab" moulding powder, the expansion and sale of "Beetle" moulding powders had followed its normal course, and they had added to the range a powder that would make transparent mouldings. They had also increased the range of their lacquer resins. The reorganisation at Streetly was now being felt in the form of considerably increased trade and an increase in profits. The best feature of the year was that they had obtained substantial orders which were keeping the presses at Streetly fully occupied during the winter months, hitherto their slack period.

Radio Rentals, Ltd., held its annual meeting on November 24th, when Mr. H. F. Hunt (chairman), who presided, said that the company's service areas now covered the greater part of England. Forty-one branches and depôts had already been opened, and it was their intention further to extend the number as favourable opportunities occurred. The business was expanding satisfactorily and the number of subscribers showed a steady increase. With regard to the future, the board thought that the company would attract increasing numbers of subscribers as the benefits of its service became more widely recognised. They could look forward to the future with confidence, provided they were not adversely affected by general trading conditions in the country.

Scophony, Ltd.—Presiding at the annual meeting held on November 30th Sir Maurice Bonham Carter, in reviewing the first year of television service from Alexandra Palace, said that so far the response of the public was disappointing, and programmes of adequate entertainment value must depend largely on the financial resources which were available for the service. He hoped that the B.B.C. and the Treasury would adopt a generous policy. The company had developed a home receiver giving a picture 24 in. by 22 in. and a larger receiver already developed for public viewing purposes measured approximately 6 ft. by 5 ft. Work on the development of larger screens was going on. The B.B.C. had taken steps to remedy the irregular timing and phase shifting in the synchronisation signals radiated from Alexandra Palace, and though some minor adjustments in the new Alexandra Palace pulse generating equipment might still be required, the company was now in a position to receive the television broadcasts satisfactorily and, consequently, arrangements were now on foot for early public demonstrations and manufacture and marketing of receivers.

The East India Tramways reports gross receipts of £67,873 for the year ended July 31st as compared with £62,785 in the preceding year, and after deducting expenses (£53,557) there is a balance of £14,316, to which is added £2,397 brought in. Reserve receives £2,000 and the final dividend is 6 per cent., making 10 per cent., and £2,714 is carried forward. The total dividend for the previous year was the same, but on smaller capital.

R. A. Lister & Co. have announced a final dividend of 5 per cent and a cash bonus of 6 per cent., making 16 per cent. for the year. A similar payment was made in the previous year, but the present distribution is payable on the 150,000 additional £1 ordinary shares issued in April last.

The Hoffmann Manufacturing Co. proposes to capitalise £129,325 of the capital reserve and £120,675 of the general reserve, and to distribute the total of £250,000 as fully-paid ordinary shares of £1 in the proportion of one new share for each ordinary share held.

The Shropshire, Worcestershire & Staffordshire Electric Power Co. is paying interim dividends of 4 per cent. on the "A" ordinary and 2½ per cent. on the "B" ordinary shares (unchanged).

The General Cable Manufacturing Co. has declared a final dividend of 7 per cent., making 13 per cent. for the year (against 10 per cent.).

Aron Electricity Meter, Ltd., has announced an interim dividend of 5 per cent., less tax (same).

Franco Signs, Ltd., is maintaining its interim dividend at 4 per cent.

The Revo Electric Co., Ltd., has declared an interim dividend of 5 per cent., actual, less tax on the ordinary shares (unchanged).

W. & T. Avery, Ltd., are paying an interim dividend of 5 per cent., less tax (same).

Stocks and Shares

TUESDAY EVENING.

THE flatness which made itself so unpleasantly apparent ten days ago has been succeeded by more cheerful conditions, induced mainly through the stepping in of "moneyed" institutions—insurance companies principally—who have laid out a good deal of capital and taken off the markets a good part of the stock and shares which had to be liquidated. This lifting of the blanket of depression served to increase the amount of business being done in most parts of the Stock Exchange. Material recovery has taken place in various directions. The strength of the gilt-edged market is one of the best advertisements that the House can desire, and with British Government stocks advancing in price, the lead is given to similar improvement in front-rank industrials. The chairman of the Great Western Railway has made the comforting assertion that his own, and some of the other railways, are deferring, until a later date, their programme for replacements and extensions until such time as the Government rearmament orders are concluded and industry will be looking for new avenues of work.

From this it is inferred that national trade is reasonably well assured of employment in the heavy industries for some years to come. Meanwhile, Home Railway traffics, Board of Trade returns, bankers' clearings, and other such pointers to the condition of industry, are moving on an upward grade. One fly in the ointment is the slowness with which export business expands. The proposed Anglo-American trade pact, and the better feeling between this country and Germany that is likely to result from the recent visit of Lord Halifax to the German Dictator, should prove useful factors in widening the scope of international business.

Industrial Markets

The past week's recovery in industrial share-prices owed something to the more cheerful news from across the Atlantic; it was, at the same time, in the nature of a natural corrective to the previous week's overdose of depression. Opinion regarding the position and prospects of Home industrial shares has taken a brighter turn. There is less glooming over the supposed inevitability of a nearby reaction in industrial activity.

The better feeling was encouraged by faint prospects of a resumption of America's rudely-interrupted recovery, and by speculation upon the benefits likely to follow from the projected trade agreement with the U.S.A. Many people regard the latter as the iron which may flatten out possible fluctuations in our own domestic activity.

Yields

The considerations mentioned in the previous paragraphs have brought in supporters for the idea that the depreciation of industrial ordinary shares has been overdone. Despite the recovery in prices, buyers can still get yields of more than 4½ per cent. from such shares as General Electrics and Associated Electricals, and anything up to 6 per cent. from other issues of proved merit. Yields of this order appear to discount such a fall in profits and dividends as might result from reaction in industrial activity. Those possessing confidence in the future of international trade are of the opinion that present prices allow for a bigger recession than is likely to take place. While awaiting further development, to-day's disposition is, in any case, to pay more attention than of late to the probable continuance of this country's industrial prosperity.

Price Movements

The abrupt reversal of the downward movement in industrial share-prices went most of the way towards making good the effects of the preceding slump. Electrical equipment shares show improvements throughout the list. General Electrics, which had fallen 7s., have recovered 5s. to 77s. Associated Electricals, at 43s., have made up the whole of the previous week's drop of 4s. British Insulated, at 4$\frac{11}{16}$, have regained a loss of $\frac{3}{8}$, and advanced a further $\frac{1}{16}$. Enfields, at 5$\frac{1}{8}$, and Henley's, at 19s. 6d., scored substantial gains in recovering approximately to the levels of a fortnight ago. Telegraph Constructions are better at 2¼, and Siemens have picked up to 28s. 9d. Improvements of 1s. or more are shown by Ericssons, now 2$\frac{1}{16}$, English Electrics, 29s., Crabtrees, 27s. 3d., Reyrolles, 60s., and various others.

Crompton Parkinson

Market expectation was well satisfied with the Crompton Parkinson profits, announced at the end of last week. Nevertheless, the price of the shares dropped about half a crown, to 44s. 6d., on the announcement, before recovering later to 47s. 6d. The first reaction was put down to a measure of disappointment over the manner in which profits are to be distributed. The customary policy of paying small cash dividends, while keeping capital and earning power in ratio by the regular issue of capital bonuses, is thought to be less to the liking of the ordinary investor than it is to, say, the payer of super-tax, who is well suited by the arrangement. There had been some expectation this year of a variation of the policy in the direction of more conventional payments. The yield on the 12½ per cent. cash dividend is, of course, of little significance: the jam in the shareholders' return comes in the shape of new shares, or in cash resulting from the sale of rights thereto. On the basis of the profits just published, and taking an "ex-all" price of 34s. 9d. for the shares, the earnings yield works out, approximately, at 8¾ per cent. on the money.

America

The encouraging effect of the week's news from America results from Mr. Roosevelt having unbent by several degrees from his unrelenting attitude towards Big Business. There are expectations of conditional concessions to the utility companies, and of some practical outcome to the vague remarks which have been made on the desirability for stimulating private enterprise. There are, in addition, plans for increasing immediate purchasing power by the acceleration of normal Government expenditure. Wall Street is, as a result, rather less off colour, but is by no means disposed to become enthusiastic while the conditions for a resumption of the forward movement in industry are still very far from settled. Business news is not encouraging, but it is recognised that improvements in this direction must necessarily lag some way behind such measures as may be taken for its good.

Miscellaneous Matters

The gilt-edged market, after momentary hesitation, shows a further general advance. Most of the British Government issues stand higher on the week. Central Electricity and other public board issues show little change, except that London Transport "A" stock, at 116 ex-dividend, is again higher. Kent Electric 3½ per cent. debentures stand at ½ premium over the issue price of 96. Traction stocks have mostly taken an upward turn. British Electric Traction deferred, at 1,000, has recovered 100 out of last week's 175 point fall. Tillings, at 57s. 9d., are 3s. 3d. up. Brazilian Tractions, at 11⅞, remain depressed by local uncertainties. Among the few changes worthy of note in electricity supply shares are a fall of $\frac{1}{8}$, to 2$\frac{1}{16}$, in Midland Electrics, and small improvements in Southern Areas, at 21s. 3d., and British Power and Light, at 25s. 9d. In the foreign group, Palestine "A" are dull, at 31s.; Perak Hydros have recovered 1s., to 22s. 6d. Cable and Wireless ordinary, at 61½, and the preference, at 100½, are each a point to the good. On the other hand, Great Northerns have fallen £1 to 37. Rubber shares advanced, on the decision to reduce the quota from 90 to 70 per cent. Iron and steel shares are better; Babcocks, in this group, have risen 3s. 9d., to 2$\frac{3}{16}$.

Share List of Electrical Companies

	Nom.	Dividend. Previous.	Dividend. Last.	Price Nov. 30.	Rise or Fall.	Yield p.c. £ s. d.
HOME ELECTRICITY COMPANIES.						
Bournemouth and Poole	1	15	15	67/6	—	4 9 0
City of London	1	7½	7½	34/6	—	4 7 0
Clyde Valley	1	7	8	2	—	4 0 0
County of London	1	10½	10½	48/-	—	4 7 6
Edmundson's 7% Pref.	1	7	7	32/6	—	4 3 7
Do. Ord.	1	8	9	38/-xd.	+6d.	4 14 9
Elec. Dis. Yorkshire	1	9	9	41/6	—	4 6 10
Elec. Fin. and Securities	1	12½	12½	2⅝	—	4 15 3
Elec. Supply Corporation	1	11	12	52/-	—	4 12 5
Lancs Light and Power	1	7½	7½	33/-	—	4 11 0
Lond. Assoc. Electric	1	—	7	31/3	—	4 9 6
London Electric	1	7	8	35/6	—	4 10 2
London Power Deb. Red.	Stock	5	5	106½	—	4 14 0
Metropolitan	1	10	10	45/-	—	4 9 0
Midland Counties	1	7½	8	36/6	—	4 7 6
Mid. Elec. Power	1	8	9	2$\frac{1}{16}$	−$\frac{1}{16}$	4 7 4
North Eastern Electric Ordinary	1	6	7	31/-	—	4 7 6
Do. 7% Pref.	1	7	7	34/-	—	4 2 4
Northampton	1	10	10	45/-	—	4 9 2
Notting Hill 6% Pref.	10	6	6	14	—	4 5 9
North Met. Elec. Ordinary	1	10	10	46/3	—	4 6 6
Do. do. 6% Pref.	1	6	6	30/-	—	4 0 0
Scottish Power	1	8	8	36/6	—	4 7 6
South London	1	7	7	32/-	—	4 7 6
Whitehall Elec. Invst. 7½% Pref.	1	7½	7½	1	—	7 10 0
Yorkshire Elec.	1	8	8	39/6	—	4 1 0
PUBLIC BOARDS.						
Central Electricity, 1950–70	Stock	5	5	113	—	4 8 6
Do. 1955–75	„	5	5	115	—	4 7 0
Do. 1951–73	„	4½	4½	110	—	4 1 10
Do. 1963–93	„	—	3½	98	—	3 11 5
London Elec. Trans. Gtd.	„	—	2½	90	—	2 15 6
London & Home Counties, 1955–75	„	4½	4½	109	—	4 2 7
London Passenger Transport, A	„	—	4½	116xd.	+1	3 17 9
Do. do. B	„	—	5	119xd.	—	4 4 0
Do. do. C	„	4	4½	81	—	5 5 0
West Midlands Joint Elec. 1948–68	„	—	5	112	—	4 9 3
TELEGRAPH AND TELEPHONE.						
American Tel. & Tel.	$160	9	9	147½	+2	6 2 0
Anglo-Am. Tel. Pref.	Stock	6	6	115½	—	5 4 0
Do. Def.	„	1½	1½	28½	—	5 5 3
Cable & Wireless 5½% Pref.	„	4½	5½	100½	+1	5 9 5
Do. Ord.	„	—	—	61½	+1	—
Do. Income	„	—	—	101½	—	3 18 10
Globe Tel. & Tel. Ord.	10	4½*	5½*	15	+½	3 13 4
Do. do. Pref.	10	6	6	13⅞	—	4 6 6
Great Northern Tel.	10	20	20	37	−1	5 8 1
Marconi-Marine	1	10	7½	28/9	—	5 4 4
Oriental Telephone Ord.	1	12*	12*	2⅞	—	4 3 6
HOME AND FOREIGN TRAMS, ETC.						
Anglo-Arg. Trams First Pref.	5	Nil	Nil	5/-	—	—
Do. do. 2nd Pref.	5	Nil	Nil	3/9	—	—
Do. do. 5% Deb.	Stock	Nil	Nil	15½	—	—
British Electric Traction Def. Ord.	„	5	5	1000	+100	—
Do. do. Pref. Ord.	„	8	8	160	—	5 0 0
Brazil Traction	$100	40 cts.	50 cts.	11⅞	—	—
Brit. Columbia Elec. Rly. Pcc.	Stock	5	5	105½	—	4 14 9
Mexican Light Common	$100	Nil	Nil	2	—	—
Do. 1st Bonds	$500	5	5	35	—	—
Victoria Falls Ord.	1	20	12	2$\frac{13}{16}$	+$\frac{1}{8}$	4 1 8
West Riding	1	6½	10	2	—	5 0 0
MANUFACTURING COMPANIES.						
Aron Electricity Ord.	1	15	15	2⅛	—	7 0 10
Assoc. Elec. Ord.	1	8	10	43/-	+4/-	4 13 0
Do. Pref.	1	8	8	37/6	—	4 5 3
Babcock & Wilcox	1	8	10	43/9	+3/9	5 0 0
British Aluminium Ord.	1	7½	10	45/-	+3/9	4 9 0
British Insulated Ord.	Stock	20	20	4$\frac{11}{16}$	+¼	4 5 3
Brush Ord.	Stock	Nil	Nil	22½	—	—
Callender's	1	15	15	4⅜	—	3 8 8
Do. 6½% Pref.	1	6½	6½	31/3	—	4 2 4
Crompton Parkinson Ord.	5/-	12½	12½	2⅜	+⅛	—
Do. 8% Pref.	1	8	8	37/6	—	4 5 4
Electric Construction	1	7	10	1⅞	+$\frac{1}{16}$	5 6 8
Enfield Cable Ord.	1	25	25	5⅛	+$\frac{3}{16}$	4 17 8
English Electric	1	Nil	Nil	29/-	+1/-	—
Do. dc. Pref.	1	6½	6½	26/0	—	5 0 0
Ericsson Tel.	5/-	20	25	2$\frac{1}{16}$	+$\frac{1}{16}$	3 0 8
Ever Ready	5/-	35	45	28/6	+6d.	7 18 0
Ferranti Pref.	1	7	7	27/6	—	5 1 10
G.E.C. Pref.	1	6½	6½	32/6xd.	+2/-	4 0 0
Do. Ord.	1	15	17½	77/-	+5/-	4 11 0
Henley's	5/-	30	15	19/6	+1/6	3 16 10
Do. 4½% Pref.	1	4½	4½	1⅛	−⅛	4 0 0
India-Rubber Pref.	1	5½	5½	21/3	—	5 3 6
Johnson & Phillips	1	⅛	10	42/6	—	4 14 1
Lancashire Dynamo	1	10	20	3½	−½	6 8 0
Siemens Ord.	1	6	7½	28/9	+$\frac{1}{16}$	5 4 4
Telegraph Construction	£1	Nil	7½	2½	+⅛	3 6 7

* Dividends are paid free of Income Tax

Published Specifications

Compiled expressly for this journal by a firm of chartered patent agents. The numbers in parentheses are those under which the specifications will be printed and abridged and all subsequent proceedings will be taken

1935

24971. "Thermionic oscillation generators." Marconi's Wireless Telegraph Co., Ltd., and D. A. Bell. May 6th, 1930. (474739.)

1936

3194. "Ultra-high frequency marker beacon systems." C. D. Barbulesco February 4th, 1935. (474663.)

6593. "Wireless aerial systems." K. H. Barbour. March 4th, 1936. (474664.)

9190. "Production of zinc coatings by electro-deposition." Imperial Chemical Industries, Ltd. March 27th, 1936. (Cognate applications 9526/36 and 12738/36.) (474449.)

9474. "Electro-magnetically operated mechanism for use in motor vehicle light deflecting and/or dipping arrangements." C. J. Evans and S. C. Evans. March 31st, 1936. (Cognate applications 34534-36 and 5392-37.) (474450.)

9684. "Electric relays." C. Ryder, R. C. Braithwaite, and Metropolitan-Vickers Electrical Co., Ltd. April 1st, 1936. (474668.)

9939. "Electrical warning and indicating devices." Automotive Products, Ltd., F. V. Brown, Gambrell Bros. & Co., Ltd., and A. Onwood. April 3rd, 1936. (474602)

10152. "Electric control apparatus." British Thomson-Houston Co. April 9th, 1935. (474747.)

12117. "Electric smoothing circuit arrangements." A. D. Blumlein and E. L. C. White. April 29th, 1936. (474607.)

12236. "Colouring treatment of anodic coatings on aluminium and its alloys." Electro-Metallurgical Research Co., Ltd., S. Wernick and V. F. F. Henley. April 29th, 1936. (474609.)

12439. "Thermionic amplifiers." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. July 26th, 1935. (474675.)

12525. "Electrically driven pendulums for clocks." O. C. Jones. May 4th, 1936. (474454.)

12578. "Thermionic valve holders." C. R. Cook. May 4th, 1936. (Addition to 414057.) (474525.)

12579. "Electric fuses." L. Weekes (Luton), Ltd, and T. H. Dryden. May 4th, 1936. (474679.)

12623. "Wireless and like receivers." Marconi's Wireless Telegraph Co., Ltd. May 3rd, 1935. (474682.)

12631. "Scanning oscillation generators." Baird Television, Ltd., and P. W. Willans. May 4th, 1936. (474683.)

12632. "Light-sensitive electron-discharge devices." Baird Television and A. Somer. May 4th, 1936. (474616.)

12634. "Radio receivers." Baird Television, Ltd., and L. R. Merdler. May 4th, 1936. (474684.)

12664. "Dynamo regulators." Joseph Lucas, Ltd., and J. A. Laird. May 5th, 1936. (474752.)

12687. "Electric condensers." Standard Telephones & Cables, Ltd., and F. N. Scaife. May 5th, 1936. (474754.)

12696. "Electric-discharge lamps used in association with fluorescent material." British Thomson-Houston Co., Ltd., and W. J. Scott. May 5th. 1936. (474526.)

12697. "Signalling systems." British Thomson-Houston Co., Ltd., and H. K. Bourne. May 5th, 1936. (474618.)

12711. "Gaseous discharge devices." W. J. Tennant (Soc. Anon. pour les Applications de l'Electricité et des Gaz Rares Etablissements Claude-Paz & Silva). May 5th, 1936. (474759.)

12718. "Electric regulating devices and systems." S. Pribil. May 5th, 1936. (474760.)

12805. "Electric furnaces." J. McDonald and G. W. B. Electric Furnaces, Ltd. May 6th, 1936. (474767.)

12815. "Electric protective arrangements." A. Reyrolle & Co., Ltd., and H. Leyburn. May 6th, 1936. (474768.)

12828. "Radio aerials." Marconi's Wireless Telegraph Co., Ltd., and E. B. Moullin. May 6th, 1936. (474769.)

12835. "Anti-theft switch devices for motor vehicles." I. Goldfinger. May 7th, 1935. (474770.)

12836. "Electro-magnetic devices for locking doors, gates, and the like." I. Goldfinger. May 7th, 1935. (474686.)

12848. "Arrangements for automatic tuning of radio receivers or the like." E. K. Cole, Ltd. July 13th, 1935. (474771.)

12866. "Electrical water-heaters." R. Burslem. May 7th, 1936. (474808.)

12881. "Television and like systems." Baird Television, Ltd., and P. V. Reveley. May 7th, 1936. (474776.)

12940. "Lamps for projecting light beams." British Thomson-Houston Co., Ltd., and J. A. V. Fairbrother. May 7th, 1936. (474779.)

12948. "Transformers with a closed magnetic circuit and controllable magnetic leakage." Soc. l'Air Soc. Anon. liquide pour l'Etude et l'Exploitation des Procédés C. Claude. October 25th, 1935. (474781.)

12965. "Electro-magnetically operated step-by-step automatic switches as used in telephone systems." Automatic Electric Co., Ltd. (in liquidation), H. D. Sharpe and R. A. Collingham. May 7th, 1936. (474783.)

13056. "Electric daylight lamps." General Electric Co., Ltd., and J. T. Randall. May 8, 1936. (474457.)

13114. "Timed controlling devices for electric switches, valves and the like." J. Philip. May 8th, 1936. (474621.)

13135. "Armature windings for three-phase rotary convertors and the like." G. W. Braham. May 9th, 1936. (474622.)

13155. "Time-base circuits particularly for television apparatus." A. C. Cossor, Ltd., L. H Bedford, and W. H. Stevens. May 9th, 1936. (474623.)

13163. "Electric cable." Callender's Cable & Construction Co, Ltd., P. V. Hunter and H. Hill. May 9th, 1936. (474528.)

13225. "Adjustable arms or supports for electric light fittings and similar purposes." T. B. Rule. May 11th, 1936. (474459.)

13283. "Electric Edison-screw lampholders." General Electric Co., Ltd., and F. C. Mayes. May 11th, 1936. (474529.)

13635. "Automatic cut-outs for electrically heated kettles and like utensils." F. C. M. Bloomer. May 14th, 1936. (474628.)

13711. "Means for preventing the twisting of flexible electric leads or cables." C. S. Parsons. May 14th, 1936. (474793.)

13988. "Electric systems of remote control." General Electric Co., Ltd., and N. C. Smart. May 18th, 1936. (474530.)

14077. "Combined electric switches and wall connectors." C. L. Arnold, R. W. Dowsett and M. K. Electric, Ltd. May 18th, 1936. (474463.)

14172. "Electrodes for electric-discharge devices." Siemens Electric Lamps & Supplies, Ltd., and J. N. Aldington. May 19th, 1936. (474632.)

14428. "Radio direction-finding equipments." Plessey Co., Ltd., and C. E. G. Bailey. May 21st, 1936. (474690.)

15240. "Manufacture of electric-discharge devices." M-O Valve Co., Ltd., and C. J. Smithells. May 29th, 1936. (474637.)

17046. "Electric welding machines." A. J. Thorneloe. June 19th, 1936. (Cognate application 20487/36.) (474473.)

18294. "Electrical inductances." Steatit-Magnesia Akt.-Ges. July 2nd, 1935. (474533.)

19773. "Insulated electric conductors." British Thomson-Houston Co., Ltd. July 16th, 1935. (474644.)

33436. "Cathode-ray oscillographs and like devices." V. Zeitline, A. Zeitline and V. Kliatchko. June 26th, 1936. (474797.)

33448. "Electric welding." B. Berghaus. December 7th, 1935. (Cognate applications 33449/36 and 33450/36.) (474553.)

34437. "Telephone systems." Standard Telephones & Cables (Material Téléphonique Soc. Anon.). December 15th, 1936. (474555.)

35122. "Electrical measuring devices incorporating cathode-ray tubes." C. H. F. Muller Akt.-Ges. December 23rd, 1935. (474710.)

35299. "Self-inductance coil." C. Lorenz Akt.-Ges. December 24th, 1935. (474711.)

1937

74. "Electrical conductors and insulating compositions therefor." Standard Telephones & Cables, Ltd. February 19th, 1936. (474712.)

473. "Arrangement for automatic tuning of radio receivers or the like." E. K. Cole, Ltd. July 13th, 1935. (Divided out of 474771.) (474798.)

4300. "Method of, and apparatus for testing for, and removing faults in coaxial electric cables." Standard Telephones & Cables, Ltd. May 1st, 1936. (474724.)

4995. "Thermal responsive switches." General Motors Corporation. October 21st, 1936. (474563.)

6265. "Electrically operated hand hammers." R. Bosch Akt.-Ges. March 3rd, 1936. (474511.)

6824. "Methods of insulating electric coil sections for voltage transformers." British Thomson-Houston Co., Ltd. March 7th, 1936. (474727.)

7409. "Means for starting up metal vapour electric-discharge apparatus." Siemens-Schuckertwerke Akt.-Ges. March 13th, 1936. (474565.)

8176. "Ionic rectifying tubes." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. March 20th, 1936. (474568.)

9303. "Antenna systems." Standard Telephones & Cables, Ltd. May 9th, 1936. (474573.)

13233. "Process for obtaining bright or semi-bright electro-deposits of nickel." Mond Nickel Co., Ltd. November 16th, 1936. (474582.)

14742. "Electrical connectors for use in plug-and-socket couplings." Carr Fastener Co., Ltd., and C. W. Oliver. May 27th, 1937. (474735.)

15548. "Electro-magnetic rail brakes." Knorr-Bremse Akt.-Ges. January 15th, 1937. (474587.)

16772. "Thermionic-valve oscillation generators." Siemens & Halske Akt.-Ges. June 16th, 1936. (474522.)

17724. "Dielectric member more particularly for use in television transmitters." Standard Telephones & Cables, Ltd. August 27th, 1936. (474591.)

24966. "Electrical condensers." E. Chiffey. February 26th, 1937. (Divided out of 473482.) (474595.)

Trade Mark Applications

The following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from November 24th:—

Operadio. No. 575936. Class 8. Radio receiving sets, loud speakers, sound amplifying apparatus embodying electronic valves, &c.—Operadio Manufacturing Co., St. Charles, Ill., U.S.A. (British representatives: Lloyd Wise & Co., 10, New Court. Lincoln's Inn, W.C.2.)

Winged Motor Van (design only). No. 580607. Class 7. Wireless telephonic and telegraphic instruments.—Warners Radio and Electric, Ltd., 45-53, Leonard Street, E.C.2.

Sonocord. No. 578974. Class 11. X-ray tubes, ultra-violet ray tubes and apparatus for electrically recording heart-beats or other physiological sounds, all being for surgical or curative purposes or in relation to the health of men or animals.—Kohl's Scientific Instruments, Ltd., Plantation House, 34, Fenchurch Street, E.C.3.

Welvin. No. 580084. Class 13. Electric fires and electric heaters (in the nature of fires).—Frank Dunderdale, 8, Withy Grove, Manchester.

Insmat. No. 580156. Class 50. Electric insulating materials composed mainly of artificial resins.—Insulating Materials, Ltd., Appleton Village, Widnes, Lancs.

Progress in Instrument Manufacture

"An Impression of Progress" is the title given by Elliott Bros. (London), Ltd., to a 71-page art booklet which has just been issued. It is intended to summarise the activities and products of the company, which was founded in 1800, and contains, in addition to technical information, 35 full-page art reproductions of equipment and installations.

New Work for Contractors

Particulars of new works and building schemes for the use of electrical installation contractors and traders

Publication in this list is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

Aberdeen.—Houses (104), Rosemount district (£55,000) for Corporation; city architect.

Addington.—Houses (46), Lime Tree Grove; Bennett & Workett. Houses (500), New Addington estate; First National Housing Trust, Ltd.

Aspull.—Premises for Lowthers (Cakes), Ltd., Cale Lane, New Springs.

Banbury.—Cinema for E. A. Bagley.

Baschurch.—Church schools; Shropshire Archidiaconal Church Board.

Basingstoke.—Dwellings (24), South Ham and Hackwood Road; G. F. Paget, architect, Municipal Buildings.

Bedford.—School, London Road estate, and enlargement of Silver Jubilee infants' school; borough surveyor.

Bexhill-on-Sea.—Houses (13), Bencroft Road; R. A. Larkin.

Birmingham.—Factory for Dunbar & Cook, Ltd., John Street; Ardon Bros., contractors, 940a, Stratford Road. School (£48,987), Lea Hall Road, Lea Village, for the E.C.; P. W. Cox, Ltd., contractor, Grove Lane, Handsworth. School, Sheldon, for the E.C.; J. A. Swan, architect, 33, Paradise Street.

Bristol.—Factories, South Liberty, Bedminster, for Bristol Development Board.

Bucknall (STAFFORDSHIRE).—Houses (532), Newhouse Farm estate; E. Johnson, Ltd.

Bury St. Edmund's.—Premises for J. H. Dewhurst, Ltd., 16, Buttermarket.

Cambridgeshire.—Mental home (£46,827); county architect.

Chelmsford.—Extension to factory, for Hoffman Manufacturing Co.

Cheshire.—School, Broadway, Cheadle, and Brookhead (Councillor Lane), Cheadle, for the E.C.; F. Anstead Browne, county architect, The Castle, Chester.

Consett.—Cinema, Harvey Street, for W. H. Cole.

Croydon.—Admission blocks at Mayday Hospital, Thornton Heath; Berney & Son, architects, 33, High Street, Croydon. Shops and offices, High Street; Progress Building Co., Ltd. Shops and offices, North End; H. G. Sumner, 141, Hammersmith Road, London, W.14.

Darfield (BARNSLEY).—Dwellings (50), East Street and North Street; Dyson, Cawthorne & Coles, architects, 25, Regent Street, Barnsley.

Derby.—Aerodrome (£21,176); borough engineer.

Doncaster.—Houses, Wheatley Park and Woodfield Road estate; borough engineer. 2, Priory Place.

Dundee.—Ice rink; W. M. Wilson, architect.

Ealing.—Extensions to premises of Ideal Cleaners, Ltd., Northfield Avenue; S. H. West, architect, 10, Central Chambers, London, W.5.

Elland.—Houses (40), with electrical work, Heathfield estate, for U.D.C.; T. Exley-Fisher, architect, Council Offices, Elland.

Ely.—Houses (20), for R.D.C.; H. L. Mullett, architect.

Enfield.—Houses, Arbour Road; Fairbrother, Ellis & Co., 29, Fleet Street, London, E.C.4. Extension to factory, Queensway; Stadium, Ltd. Enlargement of grammar school (£37,999); Spiers, Ltd.

Essex.—School, Little Thurrock; county architect.

Eston—Houses (12), Crossbeck estate; C. W. Bell.

Flimby (CUMBERLAND).—Houses (66), for North-Eastern Housing Association, Newcastle-on-Tyne; H. Oldfield, architect, 1, John Street, Workington.

Frome.—Extensions to Victoria Hospital; J. T. Parsons & Sons, contractors, Westbury.

Glasgow.—Baths, Killearn Street, fire station, Berkeley Street (£65,000), and extensions to bus depot; city engineer. Shop, bank and hotel, Argyle Street; Montagu Burton, Ltd. Rebuilding of Lyceum Theatre, Govan (£60,000); the manager.

Gravesend.—Fire and police stations (£79,720); borough architect.

Hamilton.—Factory for John and R. Finley; the manager.

Hertfordshire.—School, St. Albans (£14,798), for the County E.C.

High Wycombe.—Houses (20), Rupert Avenue, for H. F. Bird.

Hounslow.—Offices for Heston and Isleworth Corporation (£15,462); borough engineer.

Hull.—Extensions to mental hospital (£6,823); F. Bilton, Ltd.

Kettering.—Extensions to isolation hospital; Blackwell & Storry, architects, Gold Street Chambers.

Isle of Ely.—Schools, Outwell, for the County E.C.

Lancaster.—School, Torrisholme Road, Ryelands; city surveyor.

Leeds.—Cinema and shops, Roundhay Road; C. H. & F. Lax. Estate development, Greenthorpe; A. Brown. Flats and houses, Potternewton estate; city architect. Extensions to St. James Hospital (£17,648); S. Flockton.

Leicester.—Houses (400), Braunstone estate (£172,228); city engineer, Municipal Buildings.

Liverpool.—Factory for Robert Gregory & Co., Walton Hall Road, Walton; Ormerod & Banister, architects, 66, Rodney Street, Liverpool. School, Priory Road (£52,882), for the City E.C.

Loftus (YORKSHIRE).—Houses, Westfield estate; F. J. Willis & Son, builders, Hinderwell, Whitby.

London.—(DEPTFORD).—Extensions for J. Stone & Co., Ltd., Arklow Road. (LAMBETH).—Dwellings, Hemans Street (£41,480); borough engineer. (LEWISHAM).—Community centre, Whitefoot Lane estate; National Council of Social Service. (SHOOTERS HILL).—Extensions to Brook Hospital (£101,333); W. H. Gaze & Sons, Ltd., Kingston. (STEPNEY).—Flats, White Horse Lane (£765,000); L.C.C. architect, County Hall, Westminster Bridge, S.E.1. (WANDSWORTH).—Tenements, Fairfield Street (£64,445); borough engineer. (ST. MARYLEBONE).—Boys' home, Hanson Street; Seth-Smith, Monro & Matthew, 46, Lincoln's Inn Fields, W.C.2. Extensions to factory, Hatton Street; Wallis Gilbert & Partners, 15, Elizabeth Street, S.W.1. Rebuilding premises, Oxford Street; Gibson & Gordon.

Low Heskett (CUMBERLAND).—Houses (16), for Armstrong & Sons, Ltd., builders.

Macclesfield.—Bus station and garage near Sunderland Street for North Western Road Car Co., Ltd., 120, Charles Street, Stockport; H. J. Starket, architect, 15, Curzon Street, Mayfair, London, W.1.

Manchester.—Houses (216), Openshaw (£105,230), and community centre, Barlow Moor; city architect. Store (£5,000,000), for Kendal, Milne & Co.; J. W. Beaumont & Sons, architects, Manchester. Extensions to works, Clarence Avenue, Trafford Park, for Turners Asbestos Cement Co., Ltd.; R. & T. Howarth, contractors, Crossfield works, Rochdale.

Melton Mowbray.—Extensions to the Nurses' home for the Melton and District War Memorial Hospital Committee; Edwin Newham, Thorpe, contractors, End Bridge.

Meriden.—Shops and houses; R. Burfell, Ltd., Chester Road, Castle Bromwich.

Middlesex.—Clinic and library, Mutton Lane, Potters Bar, and enlargement of Western Hospital (£23,000), of local offices, Willesden (£6,000), and extensions to Redhill institution, Edgware (£150,000); county architect.

Midlothian.—Police buildings, Millholm, Musselburgh, for the County Council, £18,000, (administrative offices, court room, wireless room, &c.); county architect.

Mirfield.—Houses, Blake Hall Park; Firth, Son & Blackburn, 22, Wellington Road, Dewsbury.

Morayshire.—Rebuilding wing of Aberlour Orphanage after fire (£10,000); Canon Wolfe.

Morecambe.—Houses (12), Beaufort Road; W. M. Quale. Houses (56), Clevelands estate; F. Armistead. Houses (20), Stuart Avenue; J. Westwell.

Northern Ireland.—(ARMAGH CO.).—School, Bessbrook, near Newry, for the E.C.; G. A. Henry, architect, 48a, High Street, Portadown.

Ollerton.—Buildings for South Nottinghamshire Joint Isolation Hospital.

Oswaldtwistle.—Extensions to works for North East Lancashire Co-operative Laundries Association, Ltd., West End; J. Hayhurst, architect, 32, Richmond Terrace, Blackburn.

Oxford.—Schools, for the City E.C.

Reigate.—Two schools, for the E.C.

Repton.—Houses (50), in four groups; A. J. King, R.D.C. surveyor, Council Offices, Rolleston Road, Burton-on-Trent.

St. Paul's Cray.—Factory, Arterial Road, for Viscose Development Co., Ltd., Woldham Road, Bromley.

Seaton Valley.—Houses (160), Seaton Delaval; U.D.C. surveyor.

Sheffield.—Houses (33), Bessingby Road; Simpson Bros. Houses (14), Mona Road; J. H. S. Randall, Ltd. Houses (20), Sheffield Road; H. Seymour. Houses (24), Woodthorpe Road; J. H. Judge & Co., Ltd. Factory, Broad Lane; Kent Bros., Ltd. Enlargement of Children's hospital, Durham Road; Governors. Reconstruction of Albert Hall, Burgess Street; Gaumont British Picture Corporation, Ltd.

Shrewsbury.—Extensions to County Offices (£52,757); Edgar Crowder, Ltd.

Shropshire.—Isolation hospital, Cross Gates, police station, Bishop's Castle, school, Wellington, and extensions to technical institute, Oswestry; county architect.

Slough.—Houses (300), Baylis Court estate; U.D.C. surveyor. Houses (68), Parklane estate, near London Road; G. W. Ibbs. Shops and showrooms, 162-8, High Street; J. A. Littman. Houses (91), Oatlands Drive, Stoke Poges Lane; Manor Park Construction Co., Ltd.

Smethwick.—Houses (64), Thimble Mill Road and Beakes Road; R. Fletcher, borough engineer and surveyor, Council House.

Southend-on-Sea.—Swimming bath (£115,000); borough surveyor.

Southgate.—Clinic library and offices, Bowes Road (£15,908); Taylor Woodrow Construction, Ltd.

Stirling.—Nurses' home, Stirling District Mental Hospital, Larbert (£50,000); medical superintendent.

Sunderland.—School clinic (£4,800), Ford estate, and school for the E.C.; borough engineer.

Tunstall.—Extensions to works, Podmore Square; H. & R. Johnson, Ltd.

Waddon.—Factory, Cubitt Street; G. Crump.

Wembley.—Enlargement of County school (£31,181); Hansard, Ltd.

West Bromwich.—Houses (174), Council estate; William Cooper & Sons.

Whitehaven.—Hospital, Homewood, Hensingham (£149,500), for Hospital Committee; R. Higgins, secretary.

Wigton.—Houses (90), Brindle Field estate, for North Eastern Housing Association, Ltd.; Metrovick House, Northumberland Street, Newcastle-on-Tyne.

Supervisors at Newcastle

At a meeting of representatives of the electrical industry at Newcastle-on-Tyne recently it was decided to take steps to form a local branch of the Association of Supervising Electrical Engineers. Mr. J. W. Crowdy, past chairman of the Association, read a paper on compulsory wiring regulations and registration, embodying the report of the committee appointed by the Association. Mr. W. Cross, a member of the Council of the E.C.A., presided.